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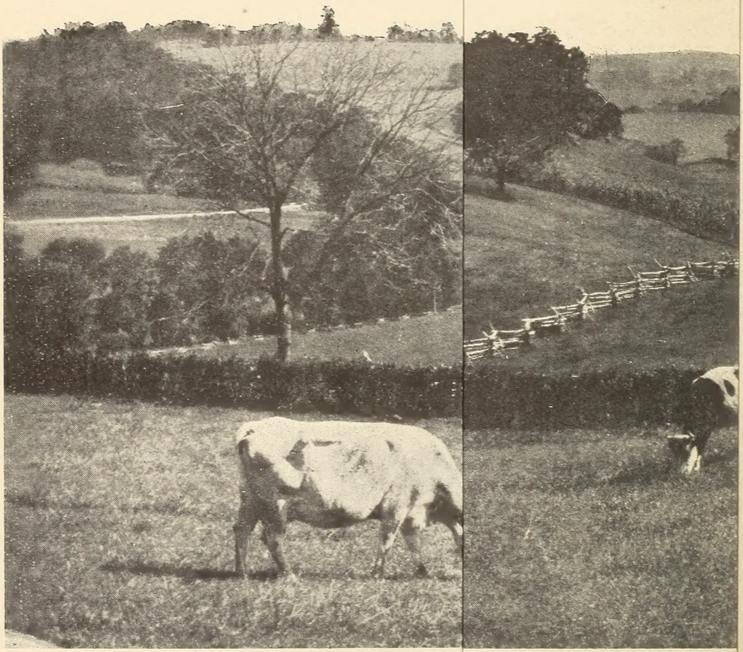

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FARM MANAGEMENT PRACTICE OF CHESTER COUNTY, PA.

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OBJECTS OF STUDY.

The objects of this study were:[1]

1. To work out a method of studying regional farm management problems.
2. To discover fundamental principles of farm management.
3. To work out the application of these fundamental principles to the agriculture of a definite agricultural region.

It is believed the system of tabulating and interpreting farm-management survey data worked out in the study of the survey made in Chester County and presented in this bulletin offers a means of interpreting such data that will render such a farm-management survey of great value in determining the best agricultural practice in any distinct agricultural region.

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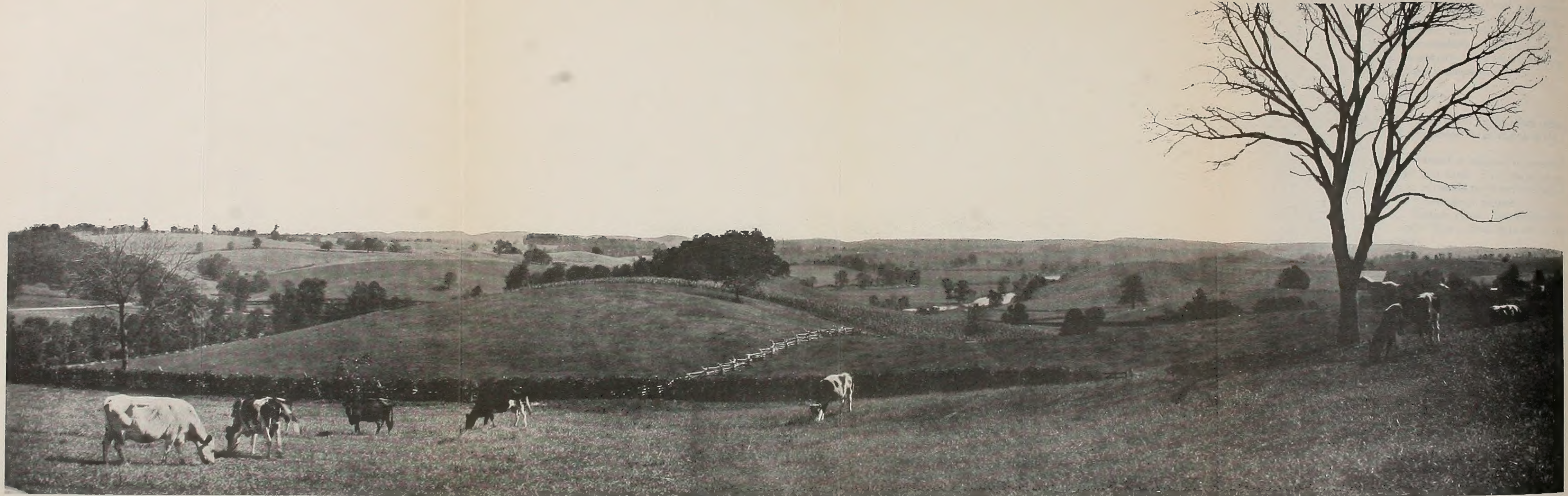
[1] Acknowledgment is due Messrs. J. I. Falconer, D. L. Cottrill, H. B. Munger, L. G. Connor, Jos. H. Hamilton, E. L. Moffitt, and H. M. Doyle, who assisted in collecting the data presented in this bulletin. Prof. F. D. Gardner, of the Pennsylvania State Agricultural College, gave valuable assistance in selecting the area studied and suggestions concerning the conduct of the work. Thanks are extended to the many farmers in this region through whose courtesy this work was made possible.

NOTE.—This study is based on the operations of 643 farms in an old and prosperous agricultural section. It is designed to develop fundamental and broadly applicable principles of good farm management.



SCENE ALONG THE BRANDYWINE, SHOWING TYPICAL CHESTER COUNTY TOPOGRAPHY.

RESULTS.

The more important of the fundamental principles of farm management brought out clearly in this study, and amply confirming similar studies, are:

The type of farming followed in any given case must be adapted to local soil, climatic and labor conditions, and especially to local conditions with reference to markets and market facilities, as well as to the business conditions existing on the individual farm.

When the conditions affecting the agriculture of a region have remained stable for a considerable period local agricultural practice tends to become approximately what it should be for best results, provided the practice which gives the best immediate returns does not unfavorably affect soil fertility. When conditions change, even slightly, if the change is permanent, local farm practice begins to change and ultimately adapts itself to the new conditions.

Success in farming, measured in terms of the family income and standard of living, is directly proportional to the magnitude of the farm business, although the per cent of profits on the farm investment is, within wide limits, independent of the magnitude of business. With the types of farming generally adapted to this locality many of the farms found in this survey are too small to permit a satisfactory standard of living.

In the matter of yield of crops per acre, the point of diminishing returns is reached on a considerable proportion of farms. Profits increase as yields increase until the yields are considerably above the average for the locality, but beyond this increased yields are obtained at the expense of farm profits.

In quantity of product per dairy cow, the point of diminishing returns is not reached in ordinary farm practice. Hence, on dairy farms, quantity of product per cow is, on the average, a more important factor of success in farming than yield of crops per acre.

It is both easier and more profitable to increase low acre yields than high ones, and a small product per cow than a large one. In other words, profits can be increased most easily by attention to the weakest points in a system of farming. The more vital the weakness the greater the increase in profits that can easily be made.

With a given type of farming, under given conditions, there is a certain way of dividing acreage among the several enterprises of the farm which is more profitable than any other way; that is, there is a most profitable acreage for each crop. Similarly there is a most profitable proportion of income from each source. If the acreage of any crop or the proportion of income from any enterprise be greater or less than this optimum, the profits of the farm as a whole are lowered thereby.

Certain enterprises may be distinctly profitable when occupying a minor position in the farm business and distinctly unprofitable if made major enterprises. This appears to be true of fruit growing in Chester County, and, to a less extent, of poultry keeping.

On small farms the expense of operation is much greater per unit of product than on large farms of similar type.

Diversity of the farm business is, as a rule, an important factor of success in farming. A medium degree of diversity, sufficient to give good seasonal distribution of labor, complete utilization of land, and a considerable variety of sale products, is better than either extreme diversity or a low degree of diversity.

The more important applications of the above principles to the agriculture of this survey area are given below. It is believed that most, if not all, of these conclusions are likewise applicable to a wide region in the Middle Atlantic States where similar conditions as to soils and markets prevail.

APPLICATION TO CHESTER COUNTY AGRICULTURE.

Most of the farmers in the region of this survey have developed systems of farming that are approximately what they should be to secure the best results, but a large minority have not. The results outlined below and discussed in detail further on should be of value to the majority in confirming their judgment and to the minority by showing them how their systems of farming may profitably be improved.

Briefly stated, these are the more important conclusions bearing directly upon the possible improvement of Chester County farming:

That the standard rotation of the section, namely:

First year.	Second year.	Third year.	Fourth year.	Fifth year.
Corn.	Corn. Potatoes. Oats.	Wheat.	Timothy and clover.	

should be changed thus:

First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.
Corn.	Corn.	Annual hay crop. Potatoes.	Wheat.	Timothy and clover.	

That oats as grain are unprofitable here.

That the average Chester County farmer should grow a little more corn than he needs for home use.

That the total hay area (including annual hay crop) should occupy between 40 and 50 per cent of the land in crops.

That it does not pay to buy hay in this region, except where the cows kept are of the highest dairy type.

That dairying should normally be the leading enterprise, with about one cow to each 4 or 5 acres of crops grown.

That the average return per cow for dairy products is $80, and that where receipts per cow are less than $50 per year *the larger the herd the smaller the labor income.*

That more heifer calves should be raised.

That steer feeding is not worth while as a main line of business except on large farms where labor is scarce.

That a few hogs should ordinarily be fed for the market.

That the region is not well adapted to sheep farming.

That flocks of 100 to 150 hens are more easily made profitable than larger or smaller flocks.

That fruit and truck should be grown chiefly for home use.

That potatoes probably occupy about their proper place in Chester County farming.

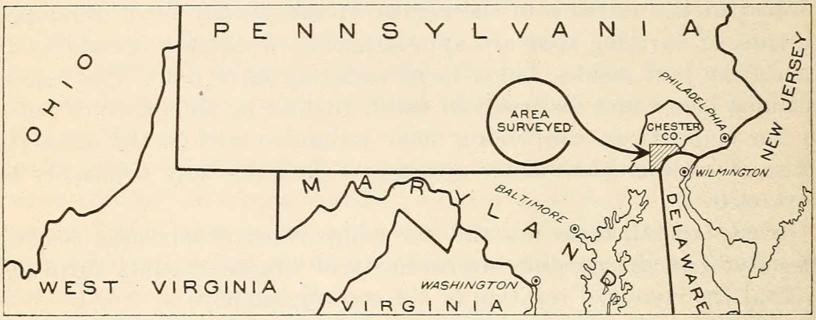


FIG. 1.—Location of area surveyed.

That yields per acre can profitably be increased up to about 40 per cent above the average. After that the labor income falls off.

That labor income increases with the size of the farm, and that the average for farms of less than 40 acres is too low to keep up a good standard of living.

That farms where diversification is about the average for the section are usually more profitable than those where farming is either more or less diversified than the average.

TERRITORY SURVEYED.

Chester County, Pa., is situated in the southeastern part of the State, a short distance from Philadelphia, and near the city of Wilmington, Del. (See fig. 1.) The area in which this study was made lies in the southern portion of the county bordering on the States of Maryland and Delaware, as shown by the shaded portion of the map in figure 1.

This area was chosen for the following reasons: The soils of the area are extremely uniform in character, thus giving uniformity to the farm practice of the region and permitting comparisons to be made without the disturbing element of variation in type of soil; the region has long since passed the stage of pioneer farming; and the forces which control type of farming have had sufficient time to assert themselves and produce a highly stable agriculture, which now changes only when economic or other conditions change. The local agriculture therefore lends itself admirably to a study of the fundamental principles of farm organization.

In this study the business of 643 farms was analyzed, a record being made of the value of all farm property; the proportion of capital invested in land, buildings, live stock, implements and machinery, supplies, and cash for current expenses; the sources of income and the amount from each; the nature and amount of expenditures; and numerous other items bearing on profit in farming. Before entering upon the discussion of the data obtained from these farms it is necessary to consider the local geographic conditions which have a bearing on the local agriculture.

TRANSPORTATION FACILITIES AND MARKETS.

Figure 2 shows the survey area on a larger scale, in which are shown the transportation lines, the country roads, and the township boundaries. The dots on this map represent the situation of the farms studied in this survey. It will be observed that one line of railway passes through the area in a general easterly and westerly direction, near the center of the area, to Philadelphia, which is 38 miles from Avondale, near the center of the area. This is the main artery of commerce for the area. Another railroad runs through Avondale in a general northerly-southerly direction. This is a crossroad connecting main roads which run north and south of the survey area, but it carries some milk to Philadelphia by way of its connection to the north. There is another railway bordering the northeastern boundary of the area over which some milk is shipped to Philadelphia.

A trolley line begins at West Grove, near the center of the area, and passes eastward through Avondale and Kennett Square, then southeastward to Wilmington, Del. This trolley carries a considerable quantity of milk to Wilmington. From Kennett Square another trolley line runs north and then northeast to West Chester, the county seat of Chester County, which lies 4 miles from the edge of the area. This line is devoted almost wholly to passenger traffic. Wilmington, Del., lies 15 miles to the southeast of Avondale, while Baltimore, Md., lies 65 miles to the southwest. A few truck farmers in the area haul their produce by wagon to Wilmington.

It will be observed that the area is well covered with country roads, though these are laid out quite irregularly. Several stretches of these roads have been macadamized. Others are fairly well graded and ordinarily in good condition, though many of the roads are poor.

By far the most important industry in the county is the production of market milk. Practically all the farms studied are less than 5 miles from a shipping point. Kennett Square is the largest village, but has little effect on the local agriculture. Its population is about 2,000.

There is practically no relation between types of farming and distance from shipping point in this area, since all the farms are fairly close to a shipping point. The principal type of farming, namely, production of market milk, is one which, by proper cooperation in delivering the product to the shipping station, is within rather wide limits little influenced by distance to the shipping point. In the absence of collective delivery of milk, distance to shipping point becomes a very important matter.

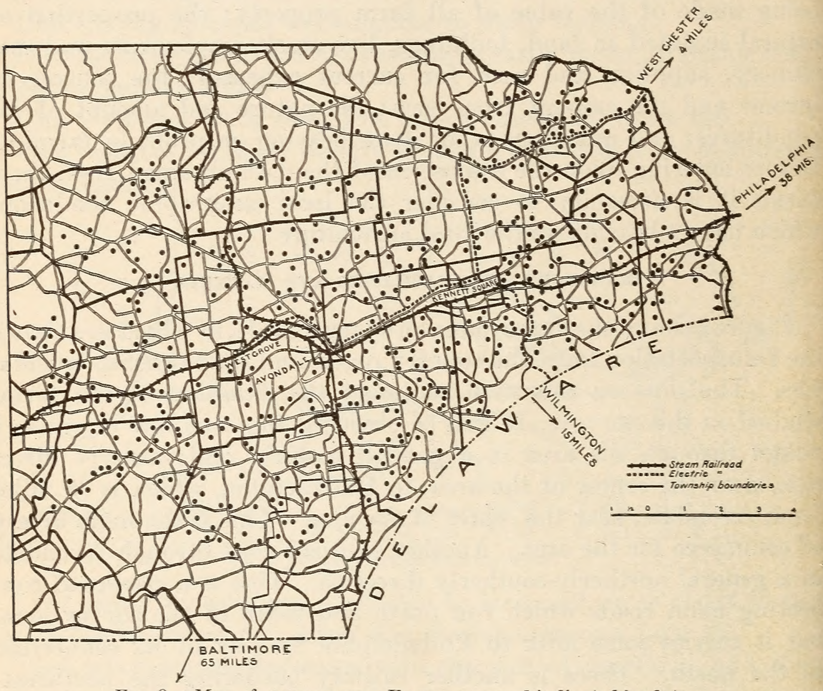


FIG. 2.—Map of survey area. Farms surveyed indicated by dots.

TOPOGRAPHY AND DRAINAGE.

Figure 3 shows the topography of the area surveyed. The heavier shading represents the higher land, the shading decreasing in density toward sea level. The lowest elevation is found in London Britain township at the south edge of the area and along the Brandywine River at the northeastern edge. In these two localities the elevation is less than 200 feet above sea level. The highest portion is in the northwestern quarter where the land rises somewhat more than 600 feet above sea level. The greatest difference in elevation to be found in the area is thus somewhat over 400 feet. When it is remembered that in some good agricultural regions differences as great as this are found on a single 200-acre farm it will be seen that the topography here is not at all rough and broken. The uplands are rolling, resembling somewhat the surface of the bluegrass area of Kentucky, though the unevenness of the surface is more marked and is cut by many streams, frequently with steep, wooded slopes. (See frontispiece.) In the western portion of the area the land is in some cases steep enough to cause more or less washing, especially where fall-plowed land is left bare during the winter. In general, however, the topography is rolling, the natural drainage being excellent except along the stream bottoms, which are generally in permanent grass. (See Pl. II.) It is seldom necessary to resort to artificial drainage on the farms in this area. Never-failing springs are found on nearly every farm, and the well-kept pastures are thus abundantly supplied with water. Some of the streams are utilized for power by means of

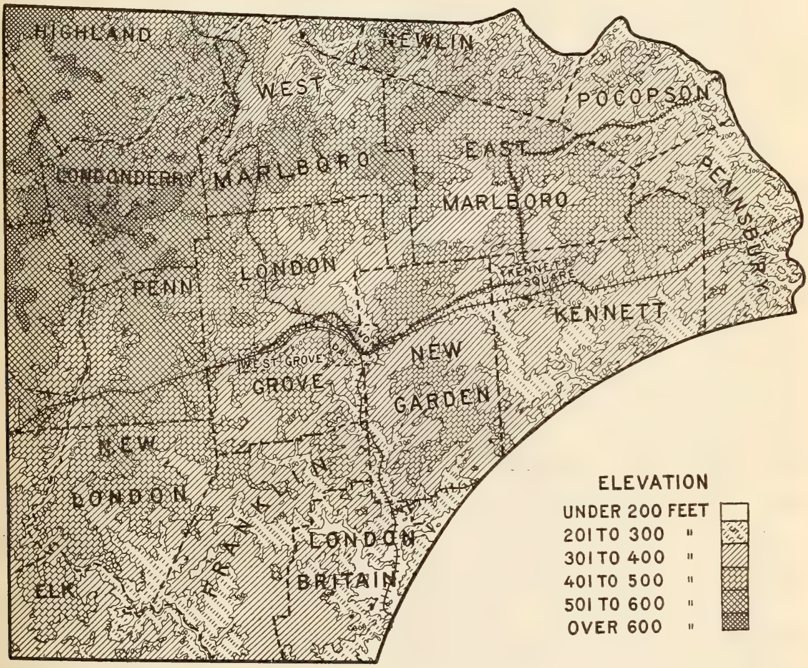


FIG. 3.—Topography of area surveyed.

overshot wheels, the principal use of this power being for pumping water to the farm buildings. In the early days many of the lowland pastures were irrigated. Some of the old trenches can still be seen.

SOILS.

Figure 4 represents the distribution of the principal soil types of the surveyed area. It will be observed that the Chester loam is by far the most important soil in the region, followed by the Manor loam. These two soil types occupy nearly the whole area, there being scattered here and there small patches of other types. This area was selected partly because of unusually uniform soil conditions. The elimination of important soil differences makes it possible to study other factors of profitableness in farming to great advantage.

The Chester loam is described by the Bureau of Soils as a silty loam, which means that it is somewhat heavier and more compact than an ordinary loam soil. The soil is, on the average, about 10 inches deep, having a smooth texture with little coarse grit except in the subsoil. The Manor loam, the next most important soil type, differs from the Chester loam mainly in containing more coarse, micaceous material. It is also somewhat less productive.

The soils of this area have in general been formed by the disintegration of granitic rocks, which are deficient in lime, though in a few places there are limited areas of limestone outcrop. The soils are not naturally highly fertile, though when properly managed they may be made distinctly so.

The pastures consist almost entirely of Kentucky bluegrass, and are remarkably productive when the deficiency of lime in the soil is considered. Their productivity is, in the main, due to the rather heavy character of the soil and to the excellent care taken of the pastures (see fig. 4). In this area farmers manure and lime their pastures frequently, and it is not uncommon to find pastures, especially those in the stream bottoms, with a carrying capacity of one cow per acre.

AGRICULTURAL HISTORY.

Records of the early agriculture of Chester County are meager. The county was established by law in 1682 and was formally organized in 1685. It was then an important agricultural area, the county seal selected in 1683 bearing a plow in recognition of its agricultural character. Indeed Chester County has always been noted for its progressiveness in agricultural matters. Some of the first American plows and hay-cutting implements were invented

DAIRY HERD ON PASTURE LAND ALONG THE BRANDYWINE.

and manufactured here, and there is still a factory making certain kinds of farm machinery at Kennett Square.

Until some time after the Revolutionary War there were no well-established and well-recognized rotations practiced by the farmers. The soil had originally been covered by timber, and it was customary to clear out an area of this, crop the land mainly to corn, wheat, rye, barley, and garden crops for a series of years until the yields became very low, when new land would be cleared and the old land left to grow up in grasses, which were used for pasture.

During the closing years of the eighteenth century a system of crop rotation began to be established, a good deal of enthusiasm having been aroused for it, and much was said and written about "the new way of farming." Thus in 1796 a Chester County farmer, writing to a friend in England, said: "Where we had Indian corn the year before is dunged by spreading this broadcast and planted to barley, oats, and flax. * * * Barley ripens about July 20, flax sooner, and oats later. We plow again in August, and sow to wheat and rye in September. * * * We sow clover the following March." It will later be seen that this is essentially the rotation which is now practically universal in this region, the only change being the sub-

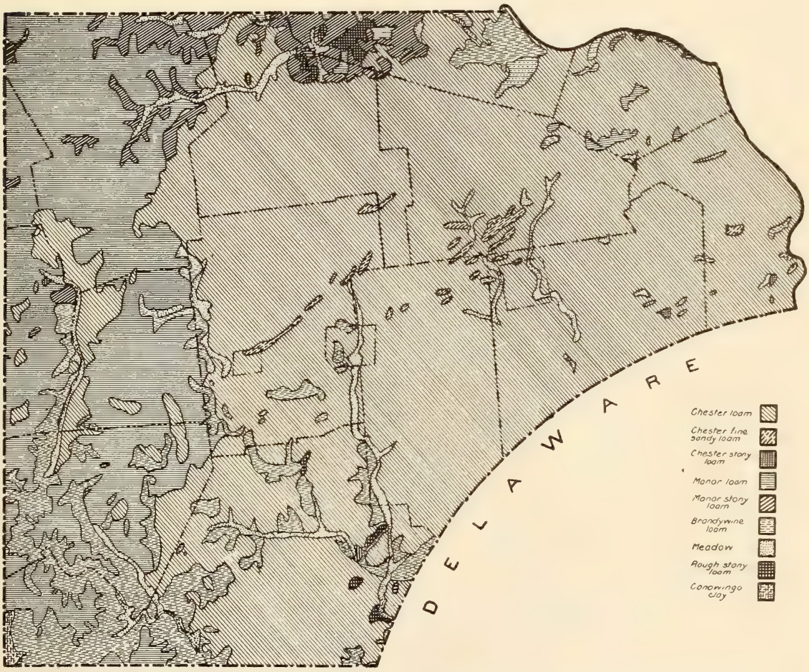


FIG. 4.—Soil map of survey area. (From report of Bureau of Soils, U. S. Department of Agriculture.)

stitution of corn and potatoes for the barley and flax of the second year and the addition of timothy to the clover at the end of the rotation.

An article in the Farm Journal in 1853, written by a Chester County farmer, describes essentially the same rotation in the following words: "The rotation is (1) corn on sod; (2) oats; (3) wheat; (4) clover and timothy mown or pastured; (5) hay; (6) hay; (7), (8), and (9) pasture." Further on in the article, referring to the oat crop, the writer remarks: "If it were convenient to plant wheat after corn, this crop would probably be dispensed with."

Thus the cropping system which is now standard in the county had its beginning about 125 years ago. It was not at all general, however, until about 1820, about which time clover became a universal crop in the county, though this crop had been introduced from Lancaster County as early as 1756.

A CHANGE IN THE LOCAL AGRICULTURE.

In the late forties (1845–1850) the agriculture of the North Atlantic States suffered a severe depression. About this time there was a marvelous extension of agriculture into the Ohio and the Mississippi Valleys. Improvements in agricultural machinery were taking place rapidly. The most important of these was the invention of the reaper. About the same time great improvements were made in plows, haying machinery, and thrashers.

As a result of these improvements the average farm family was able to farm a much larger area. For this reason the farms established in the West were larger than those of the older settled portions of the East, and production on them was less costly. The small farms of the East were not in position to compete with the larger farms on the rich soils of the West.

Table I gives some idea of the profound changes that occurred in eastern agriculture during this decade. At the beginning of the decade swine were the most numerous farm animals in Chester County, there being 64,500 of them. By 1850 their number had fallen to 36,600. The second most important animal, from the standpoint of numbers, was sheep. This industry suffered more severely than the swine industry, the decrease during the 10-year period being from 56,700 to 13,400. In 1840 Chester County had 45,000 cattle, exclusive of dairy cows. These were mainly beef cattle. But the county was unable to compete with the West in the production of beef, and the industry declined rapidly, the decline continuing till 1890, at which time cattle other than dairy cows had decreased to 12,000 head. Since that time there has been some increase in these cattle.

TABLE I.—*Census data showing changes in the agriculture of Chester County.*

Live stock and crops.	1840	1850	1860	1870	1880	1890	1900	1910
Dairy cows	16,000	19,604	25,900	32,700	42,400	49,300	45,700	45,400
Other cattle	45,000	35,500	29,900	21,100	18,400	12,000	21,700	19,700
Swine	64,500	36,600	31,500	28,200	34,000	35,600	30,500	21,400
Sheep	56,700	13,400	11,700	13,100	15,100	11,200	9,900	5,300
Milk sold (thousands of gallons)	....	....	....	1,598	5,759	24,000	17,038	20,206
Butter produced (thousands of pounds)	....	2,092	2,730	2,848	4,247	1,628	1,314	573
Wheat (thousands of bushels)	438	547	801	754	775	882	785	928
Barley (thousands of bushels)	45	2	5	1.6	.9	.2	.2	1.2
Oats (thousands of bushels)	1,080	1,146	1,227	1,034	1,137	868	925	777
Rye (thousands of bushels)	86	52	32	12	20	19	22	27
Corn (thousands of bushels)	826	1,339	1,590	1,540	1,965	1,959	2,687	1,882
Hay and forage (thousands of tons)	78	96	94	115	126	162	131	142

There were 16,000 dairy cows in Chester County in 1840. The numbers increased rather rapidly till 1890, since which time there has been a slow decrease, due mainly to a decrease in the area of improved land and to scarcity of farm labor. In 1840 dairy cows were kept mainly for production of home supplies and a small amount of butter for sale. In 1850 slightly more than 2,000,000 pounds of butter were produced. This production increased until about 1880, having doubled in this time. Since then the amount has decreased to less than one-seventh of the former maximum.

About 1870 the city of Philadelphia began reaching out into Chester County for market milk, the county supplying 1,600,000 gallons in that year. From 1870 to 1890 this industry increased enormously, reaching 24,000,000 gallons in the latter year. Since that time the business has decreased slightly, owing mainly to the decrease in the area of improved land. Corn has always been an important crop in this region, being second only to hay in acreage. Its relative importance is increasing. Wheat follows corn in acreage and has maintained about its present status for the past century.

Oats were formerly an important crop, but since 1890 there has been a gradual decrease, until at the present time they occupy only half the area of wheat in the county as a whole and only one-third in the surveyed area.

Hay has always been important and its production increased steadily to 1890. During the next 10 years it decreased considerably, mainly because of the decrease in the area of improved land.

There has been a gradual increase in potato production in Chester County since its early history, though the crop has never been an important one.

Previous to 1840 rye and barley were important crops in the county. Barley practically disappeared during the panic of the forties. Rye decreased steadily until 1870, since which time there has been a slow increase, though it is still an unimportant crop.

The production of clover and grass seed was an important industry in Chester County in 1840, but gradually declined and practically disappeared about 1890.

About 1880 a tobacco furore broke out in the county. For a few years the area increased enormously, having spread from the adjoining county of Lancaster. But the craze for tobacco lasted only a few years. Prices were disappointing and the prejudices of the farming people against the crop militated against its continuance. In the area surveyed tobacco was found on only three farms, two of them being tenant farms.

FARMS CLASSIFIED BY TENURE.

Of the 643 farms included in this survey 449 were operated by their owners, 17 were operated by farmers who owned part of the land and rented additional land, and 7 were operated by owners who rented out a part of their farms. There were 57 tenants paying cash rent, 75 paying a half share, and 14 who furnished only labor and received one-third of the products of the farm. There were three other tenants who rented land from more than one landlord and 21 of the records were incomplete and were hence discarded.

The 449 farms operated entirely by their owners were subdivided as follows: 378 farms on which the farmer himself took a man's part in the work of the farm; 16 farms owned and managed by women who did none of the farm work; 27 farms devoted wholly or in part to a hothouse business, mainly mushrooms, though in two cases carnations were grown; 1 owner received more than half of his income from business not connected with his farm; 24 farms were either operated by hired managers who received a salary or were owned by physicians or other professional men who are not really farmers but who maintain country homes; finally, there were 3 small truck farms whose owners bought and sold additional truck-crop products.

A careful examination of the tabulations in the following pages will show that the comparisons on which this bulletin is based could not well be made between the various groups mentioned above. The work is therefore limited to the 378 farms operated by owners who took full part in the work of the farm, except where otherwise noted in the text.

Brief reference is made to the 27 farms maintaining a hothouse business, and there is also a somewhat extended discussion concerning two of the classes of tenant farms mentioned above.

SIZE OF FARM AND UTILIZATION OF LAND.

Table II shows the sizes of farms found in the surveyed area, the number in each size group, and the manner in which the land is utilized. The farms were first grouped into the sizes shown in the first column of Table II. It will be observed that the number of farms is nearly uniform in the various size groups up to farms of 120 acres. Beyond this the numbers drop off so rapidly that in order to secure numbers sufficient for reliable averages it was necessary to use wider size limits in the groups. The average size of farms in the various groups ranges from 28 acres in the smallest to 203 in the largest, the average of the 378 farms being 90 acres. Of this, 71 per cent is tillable and 61 per cent actually devoted to harvested crops. Ten per cent of the entire farm area is represented by pasture on tillable land, 11 per cent by pasture on untillable land, 9 per cent by woodland, while the remaining 9 per cent represents waste land, roads, building sites, etc.

TABLE II.—*Size of farms, utilization of land, value of real estate, percentage of pasture, and crop and pasture area per animal unit, 378 Chester County farms operated by their owners.*

Sizes of farm in acres.	Number of farms.	Average size.	Tillable area.	Crop area.	Tillable pasture.	Other pasture.	Woodland.	Waste land.	Value of real estate per acre.	Pasture.[1]
		Acres.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*		*Per ct.*
13 to 40	54	28	75	67	8	9	5	11	$123	21
41 to 60	61	52	72	62	10	10	8	10	94	24
61 to 80	60	73	72	63	9	11	7	10	94	24
81 to 100	68	93	71	62	9	10	10	9	91	23
101 to 120	52	110	71	60	10	12	8	10	86	27
121 to 160	61	136	66	58	7	13	11	11	84	26
161 to 393	22	203	73	58	14	10	11	7	87	29
All sizes	378	90	71	61	10	11	9	9	90	25

[1] Per cent pasture is of total crop and pasture area.

The proportion of tillable land is approximately the same on farms of all sizes, being somewhat smaller on the larger farms, though in the very largest group it is above the average. The per cent of crop area decreases as the size of farm increases, ranging from 67 per cent of the entire farm in the smallest group to 58 per cent in the largest. The pasture area increases slightly with increase in size of farm, as does also the woodland. The percentage of waste land is about the same on all the groups except the largest, where it is somewhat smaller than the average.

The last column of this table shows the percentage of the combined crop and pasture area consisting of pasture. This increases considerably on the larger farms, ranging from 21 per cent to 29 per cent and averaging 25 per cent.

The preceding column shows the value per acre of the real estate in 1911, the year to which this survey relates (more accurately, Mar. 1, 1911, to Mar. 1, 1912). The average for the entire 378 farms was $90. With the exception of the last group, consisting of the largest farms in the area, there is a gradual and considerable decrease in price per acre with increase in size of farm, due largely to relatively greater cost of buildings on the smaller farms. There is a slight increase in the last group as compared with the preceding one, due largely to the fact that a considerable number of these large farms are owned by wealthy men who have had the capital to secure choice land and install somewhat elaborate equipment. Since that time there has been a marked increase in the price of land in this section.

The reason for the general prevalence of farms of small to moderate size in this region is largely historical. These farms were established at a time when improved farm machinery was not available and when in consequence the ordinary farm family could farm only a small area. At that time farmers produced practically all their food and clothing, and they produced very little surplus for the markets. Under such circumstances only a small proportion of the population could live in cities, for the farm population could not feed such multitudes as are found in our modern cities. When competition with the West brought on the panic of the forties, it became necessary for the farmers of the North Atlantic States to increase the magnitude of their business in order to meet the competition with these larger farms of the West. There were two methods of doing this. One was to secure more land; the other was to farm more intensively. Most eastern farmers chose the latter because it represented the line of least resistance.

In locations favorable to fruit and truck growing these industries developed enormously in this general region. So great became the production, especially of vegetables, that the business was gradually crowded off of all except the most favorably situated areas of very light soil, which could throw their products on the market very early in the season and thus get the advantage of the high prices which prevail before the markets are overstocked. The business, therefore, became practically impossible on the heavier types of soil. The only other methods of developing intensive farming were dairying, poultry raising, and tobacco growing. Several localities in the North Atlantic States particularly adapted to the production of high-grade tobacco have developed this business extensively. One of the important tobacco-growing areas is in Lancaster County, just west of Chester. Poultry are found on practically all farms in the North Atlantic States, and here and there over this entire territory are many farms devoted mainly to this business.

But the type of intensive farming available to the largest number of eastern farmers was dairying, and this whole region has become one of the most intensive dairy regions on the continent. This was the course taken by the farmers of Chester County, dairy products constituting by far the most important source of income.

TYPES OF FARMING.

One of the worst mistakes a farmer can make is to choose unwisely the enterprises that are to constitute the basis of his farm business. The swiftness with which disaster overtakes the man who makes a serious mistake of this kind causes the rapid elimination of types of farming wholly unfit in a given locality, so that, at least in the older sections of the country, we seldom find types of farming distinctly unsuited to their surroundings. But serious errors of this kind are made on a large scale in certain regions which are now undergoing settlement, and in others where real estate promotion schemes are based on the utterly false assumption that merely because the soil and climate of a region are adapted to the most intensive types of farming all the land can be devoted to the production of the most intensive crops without reference to the possibility of marketing the products.

In all sections of the country changes in economic or other conditions sometimes render well-established types of farming unsatisfactory, and it becomes necessary for farmers to make more or less radical changes in their practice. Attention has already been called to the changes in the eastern States which began about 1840, and which involved the practical destruction of the eastern sheep industry and a very great reduction in the importance of beef cattle and swine in the same region.

Another example of the effect of changes in economic conditions necessitating changes in type of farming is seen in the gradual transfer in recent years of the butter-making industry from the Eastern States to the Middle West. In the latter region, because of the larger size of the farms, the greater natural fertility of the soil, and the more general use of labor-saving machinery, grains and forage can be produced more cheaply than in the North Atlantic States. Early in the history of the Middle West the quantity of grain and forage produced made feedstuffs very cheap, and especially in the northern portion of the region the production of butter gradually became one of the leading industries. In some localities, especially in Wisconsin, cheese making also became a dominant enterprise. Butter and cheese can be shipped to eastern cities at relatively small expense. Under these conditions the makers of butter and cheese in the Eastern States found themselves hard pressed by the competition from the West. A severe depression followed, and even yet the price of farm land in the East is only just beginning to reflect the better times that succeeded with the general development of the market-milk industry incidental to the enormous growth of eastern cities. Both butter and cheese making have been largely transferred to the West during the past third of a century.

Such marked changes in type of farming as have just been mentioned practically never occur except as the result of a permanent change in economic or other conditions affecting the profitableness of types of farming. Since the market-milk business rose to prominence in the area here under consideration agriculture has remained remarkably stable, and the types of farming found are, in the main, those adapted to the prevailing conditions. Occasionally, however, a farm is found on which a wrong type has been undertaken. This is because the forces which determine type of farming are not generally understood. Even when most of the farmers of a region are following the types of farming they should follow, it is not clearly understood that this is the case, a statement the truth of which is proved by the fact that a considerable proportion of the farmers in almost every locality have undertaken things that are well-nigh impossible under their conditions. Now a farm-management survey may be made to show what types of farming are producing the best results in the region surveyed. As will appear later, the results set forth in this bulletin indicate quite clearly what local practices are most profitable, at least in many cases. These results should be useful to those who are already following the best practice by confirming their judgment and thus preventing possible departure from the best practice through lack of knowledge of what is best. It should help those who are making mistakes by pointing out to them wherein they are in error.

The conclusions reached in this bulletin concerning cropping systems and types of farming best suited to the conditions of this region will undoubtedly apply to a much wider area than that from which they are directly drawn—in short, to practically all localities in this general region in which similar conditions prevail.

Type of farming is determined by the enterprises which constitute the basis of the farm business; that is, by the crops grown, the live stock kept, etc. But since the importance of an enterprise depends on the income from it, it is customary to classify farms according to sources of income. Ordinarily, when any one enterprise produces as much as 40 per cent of the income of a farm, the farm is said to belong to the type represented by that enterprise. Relatively few farms have this large a proportion of income from a single enterprise, so that in most cases it is necessary to mention more than one source of income in describing the type of a particular farm. The farms in the area here under consideration will be considered, first, from the standpoint of the crops grown; second, from the standpoint of the live stock kept; and, third, from the standpoint of the amount of income from different sources.

CROPS.

The type of cropping system which is most general in Chester County consists of a rotation beginning with corn the first year. The second year is usually divided between corn and potatoes or oats and potatoes or corn and oats or corn, potatoes, and oats. Wheat occupies the third year, and is followed by grass, usually timothy and clover, which is ordinarily cut for hay for two years before the sod is broken up for corn, though local practice differs considerably as to the number of years the grass is left down. There are, of course, numerous modifications of this general scheme. These will be discussed later. The actual acreage of each of the more important crops on the 378 farms operated by their owners is shown graphically in figure 5. The same data are shown in percentages in Table III. Hay is seen to occupy twice the area of corn, its closest competitor. Wheat is third, occupying 18.2 per cent of the total crop area; oats are fourth, with 6.4 per cent, and potatoes are fifth, with 6 per cent. Fruit is grown on 2.5 per cent of the cropped land. In this survey no account was taken of kitchen gardens. These probably occupied about one-third as much land as the orchards. The farmers of this region grow garden vegetables very generally in sufficient quantity for home use. The truck-crop acreage given in Table III represents commercial truck crops, which are seen to be of relatively small importance in this area.

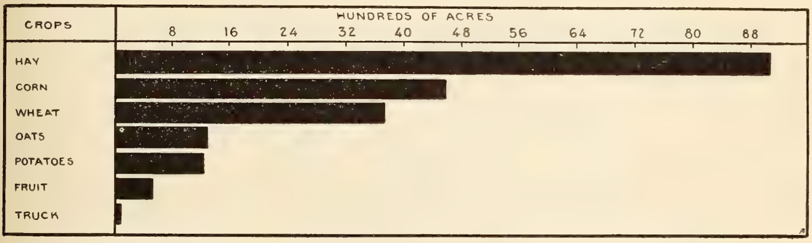


FIG. 5.—Acres of the more important crops on 378 Chester County (Pa.) farms operated by their owners.

That the area included in this survey is fairly representative of Chester County as a whole is shown by the census data for the entire county given in the third column of Table III. Potatoes and hay are a little more important in this area than in the county as a whole, while oats are somewhat less important. Commercial truck crops, special crops, especially tobacco, and miscellaneous crops occur somewhat more frequently in other parts of the county than they do in the locality of the survey.

TABLE III.—*Percentage of crop area devoted to each crop; 378 Pennsylvania owners.*

[Illinois survey data and Chester County census figures included for comparison.]

Crop.	Total crop area.		
	378 Pennsylvania owners.	Chester 1910 census figure.	73 Illinois owners.
	Per cent.	*Per cent.*	*Per cent.*
Total corn	22.3	22.1	53.9
Potatoes	6.0	4.8	(a)
Wheat	18.2	18.0	18.7
Oats	6.4	9.9	18.9
Total hay	44.0	39.0	7.3
Fruit	2.5	2.8	....
Truck	.3	.8	....
Special crops	(a)	.6	....
Miscellaneous crops	.3	2.0	1.2
Total	100.0	100.0	100.0
Total tilled crops (field)	28.3	26.9	53.9
Total small grain	24.7	28.7	37.6
Total hay	44.0	39.0	7.3

[a] Less than one-half of 0.1 per cent.

The reasons why these various crops occupy the places they do in the agriculture of this region will be discussed in some detail in another portion of this bulletin.

For the sake of comparison, the percentage area is given in Table III for the various crops on a group of Illinois farms included in a survey and reported in Bulletin 41 of this department.[1] Wheat is the only crop which occupies a similar status in the two localities. In the corn-belt area corn occupies more than twice the area it does in Chester County. This is not so much because corn is so much better adapted to the western locality; in fact, the yield of corn per acre is considerably higher on the Pennsylvania farms than it is on the Illinois farms. It is due rather to the fact that economic conditions in the western locality are not so favorable to other crops as they are in the East.

The most striking difference between the two regions is the difference in the relative acreage of hay. Hay does just as well in Illinois as it does in Pennsylvania, but economic and other conditions are not so favorable for its production. In the first place, beef cattle and hogs, which are the dominant productive live stock in the Illinois area, consume much less hay than do dairy cattle, which are the dominant type in Chester County. In the second place, the price of hay in the West is much less than it is in the East. We have here an excellent illustration of the fact that conditions other than soil and climate must be taken into consideration in determining what crops the farmer should grow.

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[1] A Farm-Management Survey of Three Representative Areas in Indiana, Illinois, and Iowa, 1914.

Miscellaneous crops.—The special and miscellaneous crops referred to in Table III were as follows: Corn for soiling, 36 farms, with an average of about 1 acre each; sweet corn, 9 farms, with 1.2 acres per farm; millet, an average of 3 acres on each of 35 farms; oat hay, 22 farms, with an average of 3.25 acres; alfalfa, 18 farms, with an average of 4.8 acres each, a total of 78.75 acres of this crop. Since this survey was made the area of alfalfa has increased considerably in this locality. A small acreage of each of the following crops was found on from one to six farms each: Rye, peas and oats, millet and rye, oats and rye, peas, barley, kafir corn and peas, and wheat, all for hay; for grain, rye, barley, and a mixture of oats and spelt; for seed, timothy, clover; tobacco, 5 acres on one farm; for soiling, rye, oats, peas and oats; for forage, beets on six farms and turnips on one farm; one-half acre of broom corn on one farm.

In a locality where there is much difference in type of farming on different farms, it is usual for the smaller farms to be devoted to the more intensive types of farming, though intensive enterprises may also occur on farms of any size. By an intensive enterprise is meant one which requires a relatively large amount of labor and capital for its conduct. Vegetable growing, fruit culture, and the hothouse business are intensive enterprises. Poultry farming is an intensive type of live-stock farming. Dairying is relatively intensive compared with sheep and beef-cattle farming. It may assume quite an intensive form, as when a large herd is maintained on a relatively small farm.

Aside from the hothouse business, which was found on 27 farms in this survey, there is relatively little intensive crop farming in this area. The reasons for this will be given later. On the remaining farms there is not much difference in type of farming on farms of different size. This is largely due to the predominance of dairying; the few farms having no dairy cows do not affect materially the averages of the various size groups.

The percentage area of the various crops on farms of different size is shown in Table IV for the 378 owner farms. The total percentage of corn acreage is about the same in each of the groups. The proportion of corn cut for silage increases noticeably on the larger farms, but this is due to the larger number of cows on these farms, not to any difference in type of farming.

The percentage of potato acreage is smaller on the large farms than on the small ones, but the actual acreage of this crop is larger on the large farms. The acreage of potatoes does not increase in the same ratio as the size of farm. The percentage of wheat acreage is remarkably uniform in the various size groups. This merely shows how firmly this crop is established in the local agriculture. It furnishes the needed straw for bedding, and acts as a nurse crop for the more important hay crop. Only 22 of the entire number of owner farms—378—grew no wheat in 1911.

TABLE IV.—*Per cent of area in various crops by size of farms on 378 owner farms, Chester County.*

Acre groups	13 to 40.	41 to 60.	61 to 80.	81 to 100.	101 to 120.	121 to 160.	Over 160.	All farms.
Number of farms	54	61	60	68	52	61	22	378
Corn	23.7	22.1	20.5	19.6	20.4	18.2	18.3	19.8
Silage	.6	.2	1.3	2.0	3.0	2.8	5.7	2.5
Total corn	24.3	22.3	21.8	21.6	23.4	21.0	24.0	22.3
Potatoes	7.9	8.5	5.8	6.8	5.9	4.9	4.9	6.0
Wheat	17.4	18.9	19.5	18.3	17.6	18.3	16.9	18.2
Oats	4.8	5.3	6.3	6.7	6.1	6.4	7.5	6.4
Hay	39.9	40.2	44.3	43.8	42.7	47.2	44.6	44.0
Fruit	3.7	3.0	2.2	2.3	3.8	1.9	1.5	2.5
Truck	1.5	1.4	.1	.1	.2	.1	.3	.3
Special [a]		.2						
Miscellaneous [b]	.5	.2		.4	.3	.2	.3	.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a] Tobacco.

[b] Millet, rye, etc.

The percentage of oats increases slightly as the size of farm increases. This is because the smaller farms can ill afford to devote their scant acres to so unprofitable a crop. The owners of the larger farms can afford to indulge their fancy for this excellent but usually expensive horse feed. As will be pointed out later, it would probably pay to replace oats by an annual hay crop in this region.

The percentage of hay acreage increases slightly with increase in size of farm. Hay is one of the most salable crop products produced in this region and brings excellent prices. Hay is also a crop which requires relatively little labor. The smaller farmer devotes more of his land to crops that give him more days' work per acre. The larger farmer already has enough field work to keep him busy and can hence afford to put a larger proportion of his land in hay.

Farms that carry a very large complement of live stock in this region put more of their land in corn and less in hay than those having less stock. They, of course, sell less hay, and the greater area of corn saves buying a corresponding amount of concentrated feeding stuffs.

The fruit orchards of this region are almost entirely for home use. The actual acreage is about the same on farms of all sizes, which accounts for the gradual decrease in percentage area with increase in size of farm.

Very little commercial vegetable growing is done in this area. What little is done, however, is seen to occupy a greater percentage area on the smaller farms, which is in keeping with the general tendency for small farms to be conducted more intensively than larger farms. If truck farming were well adapted to this area, there would undoubtedly be more of it, especially on the smaller farms.

LIVE STOCK.

The dairy cow is by far the most important farm animal in the Chester County area. This is shown very clearly in figure 6 and in Table V. Figure 6 shows the average number per farm of animals and animal units of each of the various classes.[1] There is an average of nearly 11 milk cows per farm for the 378 farms operated by their owners.

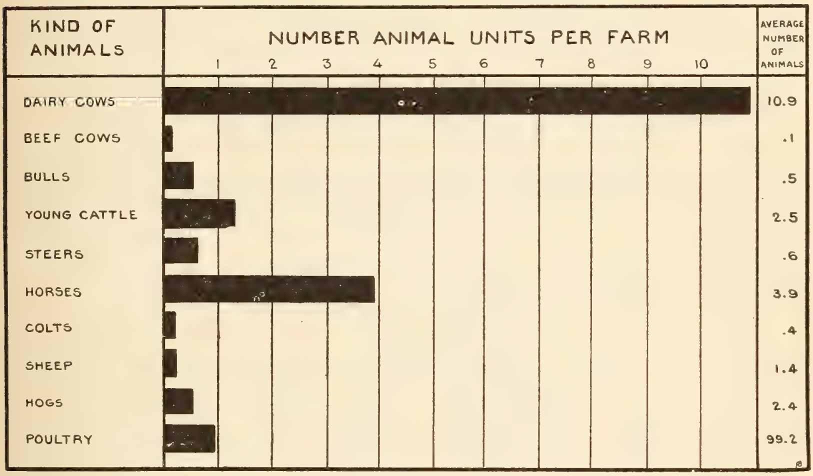

FIG. 6.—Number of animal units per farm; 378 Chester County (Pa.) owner farms.

TABLE V.—*Distribution of animals and animal units on 378 owner farms, Chester County.*

Kind of live stock.	Average number of animals.	Total animal units.	Per cent of total animal units.
Dairy cows	10.9	10.9	56.2
Beef cows	.1	.1	.5
Bulls	.5	.5	2.6
Young cattle	2.5	1.3	6.7
Steers	.6	.6	3.1
Horses	3.9	3.9	20.1
Colts	.4	.2	1.0
Sheep	1.4	.21	1.1
Hogs	2.4	.6	3.1
Poultry	99.2	.99	5.6
		19.3	100.0

The number of young cattle is only about one-fourth that of mature cows. Since in order to keep up both numbers and quality in dairy herds it is necessary to keep about 50 per cent as many young stock as mature cows, it is clear that Chester County farmers are not raising sufficient young stock to keep up their herds. It will later be seen that the major portion of the cows are bought. The reason for this is that the production of market milk is the dominant type of dairying in this region, which leaves no skim milk for the young stock. Farmers have felt that they could buy cows more cheaply than they could be raised on the high-priced milk available. In general this has been true until quite recently, but in recent years the prices Chester County farmers have had to pay for cows have risen until at the present time raising has become at least as cheap as buying. Since this survey was made (1911–12) many more calves have been saved by these farmers than formerly, and the proportion of cows bought is now less than it was a few years ago. This has an important bearing on the question of herd improvement. It is a very difficult matter to buy cows of high quality, and high productive capacity on the part of the dairy cow, as will later be shown, is one of the most important problems confronting Chester County farmers.

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[1] An animal unit is a mature horse or cow or as many smaller animals as require the feed of a horse or cow, namely, 2 head of young cattle, 5 hogs, 7 sheep, or 100 hens.

The horses kept on Chester County farms are mainly work animals. Less than one farm in three raises colts. Horse raising is thus not an important feature of the local farming, and the practice of buying western horses to feed for sale, which is common in some Central Western States, is here practically unknown.

Excepting dairy cattle and horses, poultry are the most important farm animals. The average number of hens per farm is almost exactly 100, or 1 animal unit. The status of poultry as a farm enterprise in this region will be considered in detail later. Nearly every farm keeps some poultry, but there are very few real poultry farms.

A few hogs are kept on most farms, but the absence of skim milk, together with high local prices for grain, makes the hog a relatively unimportant enterprise here. Hogs are kept mainly for home supplies, though some farmers realize considerable cash income from this source.

Beef cattle and sheep were found on only a few farms each. Most of these were farms where labor was scarce and difficult to obtain.

Table VI shows the acres per animal unit for each of the size groups. Taking the live stock as a whole, there is about the same intensity of stocking in each group, the average acres of crops per animal unit being 3.47 and the acres of pasture 1.18. The average area of crops per dairy cow is 4.89 acres. The area of pasture per animal unit increases quite markedly with increase in size of farm. This is to be expected, since the larger the farm the less intensive the farming must be for satisfactory results.

The heaviest stocking with dairy cows is found in the 41 to 60 acre group and in the 101 to 120 acre group. The reason for this will be brought out later. The two largest groups have relatively fewest cows per given area of crops, or, what is the same thing, relatively the largest acreage of crops per cow.

TABLE VI.—*Intensity of live-stock farming on 378 owner farms, Chester County.*

Size of farms in acres.	Number of farms.	Average area.	Acres per animal unit.		Crop acres per cow.
			Crops.	Pasture.	
		Acres.			
13 to 40	54	28	3.41	0.88	4.82
41 to 60	61	52	3.37	1.08	4.46
61 to 80	60	73	3.45	1.10	5.02
81 to 100	68	93	3.58	1.08	4.93
101 to 120	52	110	3.31	1.23	4.31
121 to 160	61	136	3.61	1.27	5.20
160+	22	203	3.39	1.41	5.44
All sizes	378	90	3.47	1.18	4.89

The relative intensity of the various live-stock enterprises on farms of different size is shown in more detail in Table VII. Except in the case of bulls and colts, this table gives the number of animal units per hundred acres of crops.

TABLE VII.—*Average number of animal units per 100 acres of crops for different kinds of live stock on 378 owner farms, Chester County.*

Kind of live stock.	Size of farms in acres.							All farms.
	40 or less.	41 to 60.	61 to 80.	81 to 100.	101 to 120.	121 to 160.	Over 160.	
Dairy cows	20.3	21.2	19.1	19.7	23.2	19.2	18.4	20.4
Beef cows	.5	.3	.8	.5	....	....	....	.3
Young cattle	1.6	2.3	2.0	2.3	2.3	2.4	2.6	2.4
Bulls [a]	.1	.4	.4	.6	.8	.7	.8	.5
Steers	.1	.3	2.3	.5	....	.8	4.6	1.2
Horses	11.2	8.9	7.7	7.2	6.8	6.2	6.3	7.2
Colts [a]	.1	.3	.5	.4	.4	.7	.6	.4
Sheep	....	.1	.1	.2	.8	.4	.7	.4
Hogs	1.6	.9	.4	.9	.9	2.0	1.2	1.1
Poultry	4.5	2.7	2.5	2.1	1.5	1.4	.7	2.0

[a] Number of animals per farm.

Attention is called to the fact that farms of 41 to 60 acres and those of 101 to 120 acres are relatively more heavily stocked with dairy cows than are farms of other sizes. This is believed to be due to the fact that the first of these two groups represents farms of about the proper size for one-man dairy farms, while the second is made up of farms about the proper size for two-man dairy farms. Evidence of this will appear in other tabulations.

The number of hens per farm is approximately the same for each of the size groups. For this reason the number per hundred acres of crops decreases in about the same proportion that size of farm increases.

The number of horses increases slightly as the size of farm increases, but not in the same proportion, so that there is some decrease in the number per hundred acres of crops on the larger farms.

The cattle reported as beef cows in Table VII are really dairy cows which are not milked but which are utilized in raising calves bought from near-by dairy farms that dispose of their calves at birth. Only a few such herds were encountered in this survey, and they produced very poor returns to their owners. They were mostly on farms where labor for the care of a dairy herd was wanting.

On each of the 378 owner farms of this area herds of dairy cows numbering up to about 25 were found to be fairly common. One herd of 55 and another of 80 cows were found. There were a good many very small herds, especially on the smaller farms. The young stock, which are incidental to the dairy herd, are not nearly so numerous as they should be in order to maintain the herds.

The number of bulls is about the same on farms of all sizes, but a larger proportion of the larger farmers own their bulls. In a good many cases bulls are owned in partnership, or a farm may keep a bull only part of the year. This accounts for the number of cases of less than one bull per farm. Only four farms were found having more than one bull.

Forty-two steers were found on one farm and 39 on another. Three other farms had from 20 to 24. On 19 farms 10 or fewer steers were present. Three other farms had fed a few steers during the year but had none on hand either at the beginning or the end of the year. Three of the five largest herds of steers were found on farms belonging to the largest size group. The other two were on farms which are somewhat too large for one-man exclusive dairy farms and too small for two-man farms of this type.

One or more colts were found on 112 of the 378 farms, the largest number on any one farm being 4. Several farms had colts either at the beginning or at the end of the year, but not both, which accounts for the cases of less than one colt. About 3 farms in 10 raise colts in this area.

Small flocks of breeding ewes were found on 14 farms. Only three of these kept sheep other than the breeding flock.

Brood sows were found quite generally, but in no case did the number exceed six. There was very little relation between the number of brood sows and the size of the farm. On the other hand, the larger farms fed more hogs than the small ones

Poultry were found on almost every farm, but the flocks seldom exceeded 100 hens. The largest flock consisted of 600.

SOURCES OF INCOME AND PERCENTAGE OF RECEIPTS FROM EACH.

Very few farms in the locality here under consideration can be classified as belonging to any single type other than dairying. Of the 378 farms operated by their owners, 157 obtain more than 40 per cent of their income from dairy products alone, to say nothing of the receipts from the sale of calves and discarded cows. The region is thus distinctly a dairy region, though we shall find a considerable degree of diversity in the local farming.

The sources of income[1] on the 378 farms found in this survey, together with the proportion of receipts from each source, are given in Table VIII. The same data are shown in graphic form in figure 7. In the case of potatoes it should be remarked that the price of this commodity for the year to which this study relates (1911–12) was very high, and this gives the crop a much greater apparent importance than the facts justify. On the face of the returns for this year the potato crop occupies third place as a direct source of revenue. Under average conditions it would stand fifth or sixth in the area to which this study relates. This fact should be kept in mind in interpreting the data given here.

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[1] DEFINITIONS.—A number of terms which are used in the discussion which follow are more or less technical in character. These are defined below.

The *gross income* of the farm is the sum of the receipts from all sources. The *net income* is the difference between the gross income and the farm expenses. In cases where no confusion is likely to arise from so doing, the net income will frequently be referred to simply as the *farm income;* but where reference is made to income without qualification as to gross or net the gross income is usually meant. The context will always make clear the exact meaning intended.

In most kinds of business the net income is referred to as the *profits* of the business, and this is usually expressed in percentage of the capital invested. The term "profits" is used in this sense especially in those cases in which every one connected with the business receives a salary. In such cases the net income is profit on the capital invested. But, in farming, the head of the business usually receives no salary; in this case the net income represents both interest on capital and the wages of the operator.

In dividing the net income between interest on capital and wages of the operator there are clearly two ways of procedure. We may subtract the value of the farmer's labor from the net income, and call the remainder the profit on capital. But there are very distinct advantages in dealing with the profits in farming in a different way. It will be found more advantageous to assume a rate of interest for capital invested, usually the current rate on well-secured farm loans, subtract the amount of this interest from the net income, and call what is left the *labor income* of the farmer. By using this labor income as the measure of efficiency in farming it will be seen that many useful comparisons can be made that would not be possible in any other way. In this bulletin it is assumed that capital is entitled to 5 per cent interest, and this figure is used except where otherwise stated.

Adjusted labor income.—It will later be shown that the amount of the labor income depends largely on the magnitude of the farm business, and this in turn depends on the size of the farm, especially in the case of farms similarly organized and devoted to the same type of farming. Since on the great majority of farms in the Chester County (Pennsylvania) survey area the type of farming is quite similar, the size of the farm is the principal factor in determining the amount of the labor income. But in many cases it is desirable to study the effect of factors other than size of farm. That is, it will frequently be desirable to divide the whole number of farms into classes without reference to size, and to determine the relation between labor income and the basis on which the farms are grouped. This can be done very satisfactorily in many cases by using what in this bulletin is termed the *adjusted labor income.* This is a modification of labor income in such a way as to eliminate the influence of size of farm. The method is as follows: The farms are first divided into groups based on size (area); the average of the labor incomes in each size group is then calculated; the labor income of each farm in a group is then expressed in percentage of the average labor income of the size group to which that farm belongs. Thus, the average labor income in the 61 to 80 acre group of farms operated by their owners (see Table XXIII) is $730. On one of these farms the labor income was $584, or 80 per cent of the average for the group. The adjusted labor income of this farm is thus 80 per cent, or simply 80. In some of the tables the adjusted labor income is calculated in dollars, but in most cases it is expressed merely in percentage of the group averages. A very small farm having a labor income 80 per cent as great as the average of farms of similar size and type is regarded as being as efficient as a large farm having a much greater labor income, but which is 80 per cent of the average of the size group to which the larger farm belongs. It will be found that the use of this adjusted labor income permits many important comparisons that could not otherwise be made.

Some writers on farm management limit the term *profit* to what is left of the net income after deducting interest on capital and wages for the farmer. This is clearly a use of the term inconsistent with the usual practice in the business world, but at the same time it serves to make a useful distinction. In this bulletin, however, the word "profit" is used in its more usual sense, and frequently, where the meaning intended is clear, the labor income will be referred to as the profit of the farm. This is done to avoid frequent repetition of longer phrases, but it is believed no confusion will result, since the context will always show exactly the meaning in which the term is used.

In this bulletin the 27 farms devoted either entirely or partly to the production of hothouse products are referred to as *special farms;* the 378 farms operated by their owners are usually referred to as *owner farms;* and the 124 farms operated by tenants are called *tenant farms.* Except where otherwise specifically stated, the discussions in this bulletin relate to the 378 farms operated by their owners.

TABLE VIII.—*Proportion of income from various enterprises on 378 Chester County farms operated by their owners and 73 Illinois farms.*

Sources of income.	Per cent of total.	
	378 Pennsylvania farms.	73 Illinois farms.
Dairy products	39.1	0.9
Dairy cattle	5.0	2.2
Beef cattle	1.5	23.6
Horses, mules, and colts	.4	5.2
Sheep	.5	.3
Hogs	2.8	28.4
Poultry and eggs	8.2	1.9
Miscellaneous receipts [a]	1.9	.5
Increase in feed and supplies	4.1	2.0
Corn	2.3	19.3
Potatoes	8.9	(b)
Wheat	8.5	10.7
Oats	.2	3.7
Hay	14.3	.4
Fruit	.7	.0
Truck	.5	.0
Miscellaneous crops	1.1	.9
	100.0	100.0

[a] Labor, outside the farm, wood sold, etc.

(b) Less than 0.1 per cent.

Taking the community as a whole, we find dairying occupying the place of greatest prominence. If we add together the receipts from dairy products and those from the sale of calves and dairy cows, this industry is found to account for more than three times as great a proportion of the income on these farms as any other enterprise. Hay stands second, while wheat and poultry represent other important sources of income Ordinarily potatoes stand on a par with dairy cattle here. The remaining enterprises which are of sufficient magnitude to be represented on the scale of figure 7 are hogs, corn, steers, straw, fruit, truck, sheep, horses and colts, and oats, in the order named.

For the sake of comparison with a region where economic conditions are vastly different from those prevailing in Chester County, similar data are given in Table VIII for the group of Illinois farms previously mentioned. In this Illinois area the most important source of income is hogs, the percentage of income from them being ten times as great as it is in the Chester County area. Beef cattle are nearly as important as hogs in the corn-belt area, and sixteen times as much as in Chester County. As has already been seen, the percentage of corn acreage in the Illinois area is more than twice as great as it is in the Chester County area. The Chester County farmer grows a great deal of corn, it being his second most important crop, but he uses most of this corn on the place. Many of the Illinois farmers sell their corn, mostly to neighbors who feed their own as well as their neighbor's corn to hogs and beef cattle. Corn is thus the third largest source of direct income in the western area, while in the eastern one it stands eighth. Wheat is the only source of income of approximately equal importance in the two localities.

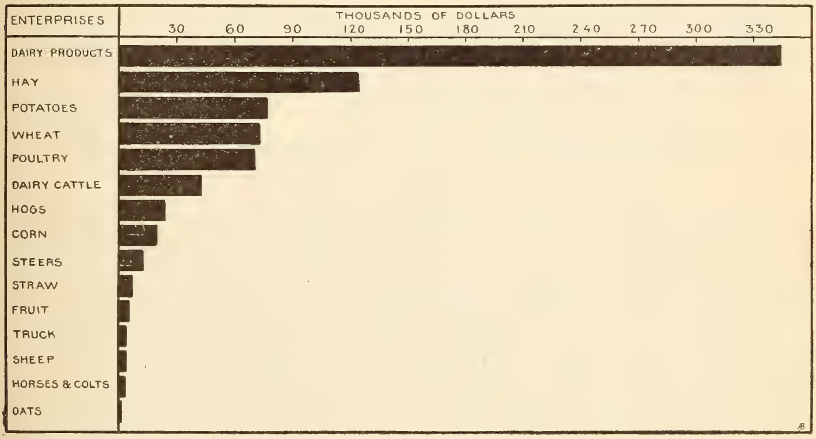

FIG. 7.—Sources and amount of receipts on 378 Chester County (Pa.) owner farms.

MISCELLANEOUS SOURCES OF INCOME.

In addition to the sources of income mentioned in Table VIII, the number of other farm products found here and there on a few farms is very small in the Chester County area. They are as follows: Seven farms sold a little corn fodder; five sold a little sweet corn; average of $22 worth of chestnuts were sold from two farms; two sold an average of $21 worth of rye; and the following products constituted a source of income on one farm each: Sweet peas, $300; cornstalks, $50; tobacco, $616; millet, $84; clover seed, $90; timothy seed, $110; and broom corn, $24.

The relation of sources of income to size of farm is shown in Table IX. The proportion of income from dairy products increases slightly till the group of farms of 101 to 120 acres is reached. The two larger groups derive somewhat less of their income from this source than the last-named group.

TABLE IX.—*Percentage of receipts from different sources, by size of farms, on 378 Chester County farms operated by owners.*

Size of farms in acres.	13 to 40.	41 to 60.	61 to 80.	81 to 100	101 to 120.	121 to 160.	Over 160.	All farms.
Number of farms	54	61	60	68	52	61	22	378
Source of income:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Dairy products	28.9	33.1	35.9	38.0	48.1	39.5	40.5	39.1
Dairy cattle	4.9	6.4	5.8	5.7	3.3	4.8	4.4	5.0
Beef cattle	.2	.1	2.5	.8	.0	1.8	4.8	1.5
Horses	.1	.3	1.4	.1	.2	.5	.3	.4
Hogs	4.5	2.8	1.2	2.8	2.6	3.8	2.3	2.8
Sheep and wool	.0	.1	.1	.3	.9	.4	1.1	.5
Poultry and eggs	18.7	11.6	11.7	8.5	6.0	6.4	3.3	8.2
Corn	1.2	2.5	2.5	2.1	2.3	2.2	3.1	2.3
Potatoes	9.3	12.4	8.6	11.0	8.2	6.9	7.5	8.9
Wheat	5.8	8.2	9.4	8.4	8.5	9.0	8.0	8.5
Oats	.2	.2	.2	.1	.1	.2	.3	.2
Hay	9.6	10.0	13.4	13.6	12.4	18.4	16.9	14.3
Fruit	1.4	1.3	1.0	1.0	.6	.2	.2	.7
Truck	3.0	1.8	.1	.1	.2	(d)	.4	.5
Special[a]	.7	.7	....	....	....	....	....	.1
Miscellaneous[b]	5.1	4.2	3.1	3.9	1.7	1.9	2.7	2.9
Feed and supplies[c]	6.4	4.3	3.1	3.6	4.9	4.0	4.2	4.1

[a] Sweet peas, 1 farm; tobacco, 1 farm.
[b] Miscellaneous crops (rye, millet, straw, etc.), labor, lumber, or wood sold, etc.
[c] Increase in inventory.
[d] Less than 0.05 per cent.

It will be noticed that the largest increase between two successive groups is between the 81 to 100 acre group and the next larger, while the second largest is between the 13 to 40 acre group and the 41 to 60 acre group. As previously stated, there are indications in much of the data collected in this survey that the 41 to 60 acre farms are approximately the proper size for a one-man dairy farm in this locality, while the 101 to 120 acre farms appear to be about the proper size for a two-man dairy farm. Dairying is therefore relatively slightly more important in these two groups than in the others. The third group (61 to 80 acres) is slightly too large for a one-man farm and yet not large enough for a two-man farm, as ordinarily organized. In this group wheat, hay, and beef cattle are all somewhat more prominent sources of income than the position of these farms in this table calls for. Being rather large for a one-man exclusive dairy farm, some of these farms are conducted on a less intensive plan. The percentage of income from wheat in this group is the largest of that of all the groups, while the income from beef cattle is relatively larger than in any other group except the last, consisting of the largest farms found in the survey.

The 81 to 100 acre group of farms approaches nearer the proper size for a two-man dairy farm, and many of them are thus organized. The two groups of largest farms, being somewhat too large for two-man exclusive dairy farms, are on the average conducted in a somewhat less intensive manner, beef cattle becoming more prominent in the last group than in any other. Sheep are also most prominent in this group. Hay is more prominent as a source of direct income on the two groups of largest farms than on any others.

In a general way, with some exceptions, beef cattle, sheep, and hay increase in relative importance with increase in size of farm, though the increase is slight and rather irregular. These represent the less intensive enterprises. But the more intensive enterprises, such as poultry, potatoes, fruit, and truck crops, decrease in relative importance as the size of the farm increases. In the case of poultry, the actual income is approximately the same in each of the size groups. The same is true of the income from fruit. In the case of potatoes, the actual income increases slightly with increase in size of farm, while in the case of truck crops it decreases.

We have already seen that the percentage of wheat acreage is remarkably uniform in the different size groups. With the exception of the very smallest farms, on which the small quantity of wheat grown is largely used for chicken feed, the percentage of income from wheat is quite as uniform. Except in the first group, there is only one group in which the figures vary more than one-half of 1 per cent from the average of 8.5.

The number of farms other than dairy farms in this area is too small to permit definite conclusions concerning the relation of size of farm to type of farming; but if we compare the average area of the farms deriving as much as 20 per cent of their income from the various enterprises, we get the interesting result that the 106 farms deriving as much as 20 per cent of their income from the sale of hay average 105 acres in area. This is considerably higher than the average of 90 acres for the whole number of farms. Likewise the 10 farms deriving more than 20 per cent of their income from steers average 128 acres, and the two deriving this much of their income from sheep average 108 acres. These are the less intensive enterprises and tend to gravitate toward the larger farms. On the other hand, farms deriving as much as 20 per cent of their income from the more intensive enterprises average as follows: Poultry, 51 farms, 56 acres; potatoes, 39 farms, 78 acres; truck crops, 4 farms, 33 acres. These facts are all in keeping with the principle that the smaller the farm the more intensive must the farming be for best results, provided, of course, the region is one in which the more intensive enterprises can be made successful.

The foregoing data relate entirely to the 378 farms operated by their owners and not maintaining a hothouse business. There were 27 of the latter, their average size being 62 acres. Several of them are farms of less than 40 acres, but there is an occasional large farm which runs a mushroom plant as a side line, though in some cases it represents the principal source of income even on these large farms.

It is a business which may be made successful on a very small area, but which may also constitute part of the business of a farm of any size. This is generally true of very intensive enterprises.

CROP AREA AND CROP RETURNS IN RELATION TO LABOR INCOME.

The farmer has often been told that he should keep careful cost-accounting records as a means of determining what enterprises are the more profitable, thus enabling him to increase the magnitude of the more profitable enterprises and eliminate unprofitable ones, thereby increasing his net profits. Many farmers have undertaken to do this, but in many cases the results were such as to be contrary to the farmer's better judgment, and the attempt was often abandoned. We shall here see that this doctrine is more or less of a fallacy. The actual cost of conducting a farm enterprise can not be arrived at by ordinary bookkeeping methods. The profit a farmer makes is not infrequently due to the fact that his business is based partly on enterprises that the usual methods of cost accounting would show are conducted at a loss. The fact is that the real cost of a farm enterprise depends not on the labor and materials devoted to its conduct, but, in part at least, to its relation to the other enterprises maintained on the same farm. Thus, on a farm which produces corn and hay as its principal field crops most of the equipment and labor required for producing wheat are already at hand and would not be fully utilized if wheat were omitted from the rotation. Under such conditions a limited area of wheat might add to the profits of the farm, even if cost accounts showed that it returned less than the current rates of wages to the grower.

Similarly, a small flock of hens on the farm will find much of their living in insects, weed seeds, and the grain that would otherwise go to waste about the place. The time devoted to them may be largely that of women and children, who would otherwise not be earning anything. The materials used in constructing the quarters in which they are housed may consist largely of scrap lumber picked up here and there, and which would otherwise have no value. Under such conditions a small flock of hens may add materially to the profit of the farm when cost-accounting records would show them to be a losing proposition. But the story is a different one when the flock becomes so large that it can not be fed largely on waste materials and when the time devoted to it is time that could otherwise be employed at profitable productive labor.

As will be seen in what follows, there appears to be, under given conditions, a most profitable magnitude for many of the enterprises of these farms. Within certain limits, which can usually be ascertained by farm-management survey methods, a farm enterprise may add materially to the profits of the farm business, while if the enterprise be made either smaller or larger than this the profits are reduced. Generally speaking, the farmers in the older settled agricultural sections have arrived at this optimum magnitude for the various enterprises they maintain on their farms. But they have done this in response to the action of obscure economic forces which are not clearly perceived. Hence many of them make mistakes in the matter of the relative magnitude of the enterprises they maintain. One of the most important lessons to be learned from a study of the kind reported in this bulletin is the position each enterprise should occupy on the farms of a given locality for best results. *In order to be able to determine this point, however, it is necessary that the survey include a large number of farms, and that these farms may be separable into large groups in which approximately the same mixture of farm enterprises occurs on all the farms within the same group.*

The adjusted labor income, of which use is made in the following tabulations, has already been explained. (See footnote, p. 25.) It has been calculated in such a way as to eliminate, as far as possible, the effect of magnitude of business on the labor income. Within a given region magnitude of business probably has more influence in determining the profit made by the farmer than any other one factor. In order to study the influence of less important factors satisfactorily, it is therefore desirable to eliminate this one. It would also be highly desirable to eliminate the factors of yields of crops per acre and income per animal unit, which are the next most important in studying such minor factors as percentage area of each crop, percentage of income from each enterprise, etc., but the number of farms available for this study is not large enough to permit this.

In some of the tabulations it will be seen that a relatively slight change in the percentage area of a given crop, or in the percentage of income from a given enterprise, appears to make a very decided difference in the profits made by the farmer. In some cases this difference is too great to be accounted for merely by the difference in crop area or in percentage income under consideration. This is particularly true in the case of the relation between percentage of income from fruit and labor income. (See p. 40.) A very slight increase in percentage of income from fruit amounting to less than 1 per cent of the total amount of income from these farms is accompanied by an increase of 18 per cent in the average labor incomes.

The reason for this is probably not because of the additional profits secured from the sale of fruit, but because in the main it is only the better class of farmers who take any care of their fruit and who go to the trouble to market the small surplus of this commodity they produce. They are thus better farmers all round than the others, and for this reason make much better labor incomes.

It must not be assumed, however, that this reason accounts for the results in all these tabulations. There is no reason for believing that the actual conclusions in any case are different from what they should be because of this effect. The results are simply magnified by it. In general the better farmers of the community do not depart widely from the average practice of the community, but the very fact that this is true is of itself evidence that in the case of most enterprises there is a normal status, departure from which interferes with the efficient management of the farm.

Thus those farmers who have 30 to 39 per cent of their crop acreage devoted to corn make greater profits than those having more or less than this. Similar conditions are shown for the other crops. It appears that the more alert farmers in this region have recognized at least to a considerable degree, the status which each of their enterprises should occupy for the best results. These men are, in general, better farmers than their neighbors.

It must not be concluded, however, that an unusual acreage of one of the important crops of the region is without influence on profit. There is undoubtedly a balance between the enterprises of the farm; a status of each enterprise which fits best into the local system of farming. Wheat, although not a highly profitable crop here, has its place in the system. It furnishes straw for bedding and offers opportunity for seeding the more important and more profitable hay crop. It also occupies the time of farm laborers and teams and utilizes farm equipment at seasons of the year that would not otherwise be fully occupied. Hence, although the crop is less profitable per acre than corn or hay, a certain percentage of acreage devoted to it makes the farm more profitable than if the crop were omitted.

That the conclusions drawn in the following pages concerning the most profitable status of each of the enterprises are, in the main, correct is strongly indicated by the three cases in which these conclusions indicate that the average practice of the community is not in keeping with the highest profit, or at least was not during the year of this survey. The first of these cases relates to the acreage of the corn crop.

The average per cent of corn acreage for the 378 farms is 22.3 of the total crop area. Table X indicates that the most profitable acreage is between 30 and 39 per cent. The most progressive farmers in this locality all agree that more corn should be grown locally than is grown, and a good many of them have in recent years let corn occupy two whole years in their rotations. Census data show that the relative acreage of corn has been increasing in recent years in Chester County. It will be remembered that about a decade and a half ago the price of corn rose about 50 per cent in this country, and has remained at this level ever since. It is probable that under the old conditions the farmers of Chester County had come to the proper acreage of this crop, but with corn at its new high level of prices a larger percentage of corn acreage would be justified. Census data thus show that the farmers are slowly responding to the slight economic forces tending to force them in the direction of higher profit. The data of Table X indicate that the direction in which they are moving, as shown by census returns, is actually in the direction of higher profit, while the opinion of the best local farmers agrees both with the indications of Table X and of the census returns.

Another instance in which local practice is not consistent with the highest profits, as indicated in Table XIV, relates to the percentage of oats acreage. This table indicates that those farmers who grow no oats make much higher profits than those who devote a portion of their land to this crop. The best local farmers agree that the oat crop is not profitable here, and 140 of the 378 owners grow no oats. Furthermore, census statistics show that the relative acreage of oats in this county is slowly decreasing.

The other case relates to the percentage of potato acreage and the proportion of the farm income derived from this crop. In both cases the data collected in the survey show that the more important the potato crop on the farm the higher the profit, and the tabulations indicate that the limit of profit in this direction is not reached by local practice. Yet most of the farmers of this region state that they do not consider potatoes distinctly a profitable crop. They grow them largely to fill in certain vacant places in the labor schedule. But during the year to which this survey relates these farmers sold their potatoes at an average price of $1.04 a bushel. The inference from the data is that if potatoes sold at this high price regularly, the percentage of acreage devoted to potatoes in this region should be much larger than it is now. The fact is, however, the average price of potatoes here, as elsewhere, is very close to the cost of production, and there is every reason for believing that the farmers are right in their opinions concerning the value of this crop.

The fact that the tabulations to be discussed presently lead to conclusions which are thus in agreement with the opinions of the more progressive of the local farmers, *even when these conclusions are not in agreement with average local practice*, and the further fact that good reasons can be given for the changes called for by the tables, give great weight to the conclusions drawn from the assembled data.

While data are not at hand to prove it, it seems probable that the status which a crop should occupy for best results in a system of farming would depend on the yield of that crop per acre. A crop which yields well on a given farm compared with other crops should probably occupy a larger acreage than the same crop on another farm where it yields poorly in comparison with other crops. It is also probable that in two localities similar in all respects, except that in one the crops produce low yields while in the other the same crops produce good yields, the optimum status of the individual crops would be different in the two regions. Conclusions based on studies in one region should certainly not be applied too broadly in other regions in which conditions are different.

Corn.—We have already seen that on the average the corn crop occupies 22.3 per cent of the entire crop area in the area here under consideration. Percentages as low as about 13 and as high as about 33 are fairly common, the extremes being 8 and 55. The more frequent percentages of this crop are from 18 to 25. While the corn crop is nearly universal on these farms, and in a large number of cases occupies from one-fifth to one-fourth of the crop area, there is seen to be considerable variation in the percentage of corn acreage on the different farms. The question arises, What percentage of corn acreage is most profitable under the conditions which prevail in this locality? The answer to this question will depend to some extent on the intensity of the stocking of the farm. In general, those farms which are most heavily stocked have the largest percentage of their land in corn. But we may first consider the matter from the standpoint of the average conditions prevailing in the region.

Table X classifies the 378 farms into groups based on the percentage of their crop area devoted to corn.

TABLE X.—*Percentage of crop area in corn as related to labor income.*

Per cent of crop area in corn	0 to 19.	20 to 29.	30 to 39.	40+.
Number of farms	138	188	42	10
Adjusted labor income	94	102	121	52

Average percentage of corn area on the 378 farms, 22.3.

It will be noticed that the average labor income of the 138 farms having from 0 to 19 per cent of corn acreage is 6 per cent below the general average of the region. One hundred and eighty-eight farms had 20 to 29 per cent of corn acreage, and their labor incomes are 2 per cent above the average. In the next higher group 42 farms have an average labor income 21 per cent above the general average. Unfortunately, the number of farms in the next group is small, but it will be noticed that the average labor income on them is very low.

It will be remembered that the original form of the common rotation of this region had corn the first year only. In recent years the price of corn has risen very materially as compared with two decades ago, and corn has begun to invade the second year of the rotation. On some farms it is beginning to occupy the whole of the first two years. The greatest number of farms is in the group next below that which appears to be the most profitable. But the farmers here are increasing the percentage of their corn acreage very materially, as an examination of the census statistics for the last two census years will show. In other words, the farmers are slowly responding to the economic pressure tending to drive them toward a more profitable cropping system than that which now generally prevails.

The average percentage of corn area for the entire number of farms (22.3 per cent) is in the group of Table X next below the most profitable one. This study confirms the opinion of the most progressive farmers of this region to the effect that they ought to increase their acreage of corn.

As previously stated, corn is here grown mostly for feed. But a considerable number of farmers grow more of it than they need for this purpose, selling a small surplus. Does it pay to do this? Would it pay better to sell all their corn, for which they can get very good prices, rather than feed it to the classes of live stock kept on these farms?

It was found that 127 of the 378 owners sell some corn. In fact, this crop constitutes the direct source of 2.3 per cent of the entire receipts of the 378 farms. In nearly all cases where corn is sold, the percentage of income from it is less than 20, and in only two cases is it more than 26. In the greater number of cases it is less than 10 per cent.

Table XI shows that the 251 farms that sell no corn make an average labor income considerably less than the 121 farms that derive from 1 to 19 per cent of their income from this source.

TABLE XI.—*Percentage of income from sale of corn as related to labor income.*

Per cent of income from sale of corn	None.	1 to 19.	20+.
Number of farms	251	121	6
Adjusted labor income	95	113	55

It evidently pays to sell some corn. Unfortunately, the number of farms in the next higher group is too small to give a decisive result, but it is significant that the average labor income of these six farms is exceedingly low. Apparently, it also pays to feed a part of the corn.

Potatoes.—On the farms here under consideration 6 per cent of the crop area was devoted to potatoes. They were found on 366 of the 378 farms operated by their owners. This crop is, therefore, very general in this region, though the acreage is usually small. In by far the larger number of cases the acreage, expressed in percentage of total crop area, was found to be less than 10 per cent, which means less than 6 acres per farm. On only 7 farms was the percentage of potato acreage found to exceed 20 (or 12 acres). The farmers of this area do not generally regard potatoes as a profitable crop, though they grow at least enough for home use and usually some for sale. The yield is low, the average being only about 79 bushels. The principal difficulty is in the character of the soil, which is rather too heavy for best results with this crop. The price also fluctuates greatly, and on the average is little more than sufficient to cover the cost of production. Yet the crop helps to fill the labor schedule, and when kept within proper acreage limits probably adds somewhat to the profits of the farm business in the average year. During the year to which this survey relates the average price at which the farmers sold their potatoes was $1.04, which is much above the normal. With prices like this the tabulated figures show that the farm profits increase both with increase in acreage of potatoes and in proportion of receipts derived from their sale. It is certain, however, that this does not represent normal conditions for this area, and hence the tabulations are omitted.

One of the defects inherent in the survey method of studying farm-management problems lies in the fact that unless conditions are normal at the time of the survey the results may be misleading. This difficulty can be overcome in a number of ways, one of which is to repeat the survey in the same locality for a sufficient number of years to establish a normal for each enterprise. Fortunately, however, conditions were approximately normal in this area at the time these data were obtained except in the matter mentioned, and in the fact that the price of hay was somewhat above normal. In the main, therefore, the results are reliable.

Wheat.—Wheat occupied 18.2 per cent of the total area of crops on the 378 owner farms. This crop occurred on 356 farms. In most cases the percentage of wheat acreage fell between 15 and 25 per cent, but on several farms it was greater or less than these limits. The average proportion of income from the sale of wheat was 8.5 per cent of the total farm income, as shown in Table VIII. In relatively few cases did a farm receive more than 20 per cent of its income from this source.

The most profitable acreage of this crop is shown in Table XII. The labor incomes of the 28 farms having less than 10 per cent of wheat acreage was much lower than the average of all farms.

TABLE XII.—*Percentage of crop area in wheat as related to labor income.*

Per cent of crop area in wheat	0 to 9.	10 to 19.	20 to 29.	30+.
Number of farms	28	213	121	16
Adjusted labor income	63	107	97	96

The 213 farms having 10 to 19 per cent of wheat acreage made profits considerably above the average. In the next higher group there are 121 farms, sufficient to give an average having a definite meaning. Their labor incomes averaged 10 per cent lower than in the preceding group. In the remaining group the number of farms is small, and they need not be considered. The results for the first, second, and third groups are apparently conclusive. They indicate that an acreage of wheat equal to 10 to 19 per cent of the total crop area is more profitable on these farms under normal conditions than either a larger or a smaller acreage. This merely means that wheat should here occupy one year in the rotation. But it appears to be more profitable to run wheat twice in the rotation than to omit it altogether.

It is interesting to note that not only is the largest number of farms in this most profitable group, but the average for the 378 farms falls within the limits of this group. Wheat has occupied approximately its present position in the agriculture of this region for more than a century, a sufficient length of time for the farmers to have found the most profitable acreage of it. Yet the facts have not been definitely recognized by these farmers. Many of them grow either more or less wheat than these results indicate they should.

The figures for percentage of income from wheat are in close agreement with the above, and confirm the conclusion that on the major portion of these farms this crop occupies its proper position, as is seen in Table XIII.

TABLE XIII.—*Relation of percentage of income from wheat to labor income.*

Per cent of income from wheat	None.	1 to 9.	10 to 19.	20+.
Number of farms	36	204	121	17
Adjusted labor income	79	121	82	19

Average percentage of wheat area on the 378 farms, 18.2.

Thirty-six farms sold no wheat. Their labor incomes average much lower than the general average. Two hundred and four farms derive from 1 to 9 per cent of their income from the sale of wheat. Their profits are much above the average. One hundred and twenty-one farms received from 10 to 19 per cent of their income from this source and made profits much below the average. The number of farms deriving more than 20 per cent of their income from wheat is small. This fact is in itself significant. While their number is too small to give a very significant average, the fact that this average is exceedingly low is consistent with the other data of this table and those of Table XII. These figures indicate that while the place wheat should occupy on these farms is one of moderate importance, it is disinctly more profitable to grow a field of wheat in the rotation than not to do so under the conditions prevailing in this region.

The high prices for wheat which have prevailed during the latter part of 1914 and the early months of the present year (1915) would undoubtedly justify a larger percentage of wheat acreage than that here indicated, but these conditions are abnormal. The price of wheat will undoubtedly fall again to about its previous normal level when the present disturbed conditions have passed. It would, therefore, probably be wise for the farmers of Chester County to continue their present practice with reference to this crop.

Oats.—The oat crop occupied 6.4 per cent of the crop area on these farms in 1911. It was found on 238 of the 378 owner farms. In only six cases did it exceed 20 per cent. This crop occupies a portion of the second year in the common rotation, along with potatoes and some of the corn. That it would pay better to omit oats entirely from the cropping system is clearly indicated in Table XIV, where it is seen that the 140 farmers growing no oats made profits 17 per cent above the average, the 141 farmers having from 1 to 9 per cent of oat acreage made profits 2 per cent above the average, while the 97 farmers having 10 per cent or more of their crop area devoted to this crop made profits 27 per cent below the average.

TABLE XIV.—*Percentage of crop area in oats as related to labor income.*

Per cent of crop area in oats	None.	1 to 9.	10.
Number of farms	140	141	97
Adjusted labor income	117	102	73

Average percentage of crop area in oats, 6.4.

Attention is elsewhere called to the fact that an annual hay crop might profitably replace oats in the common rotation system prevailing here. The quantity of oats sold by the farmers of this locality is too small to permit any conclusions being drawn concerning the relative profitableness of feeding or selling this product.

Hay.—Timothy and clover hay occupy 44 per cent of the crop land on the farms here under consideration. Only two farms had none of this crop. Few farms have less than 30 and few more than about 55 per cent of their crop land in hay. The total area of other kinds of hay is so small that it may be neglected without serious error. The data given in Table XV show that the largest number of farms have from 40 to 49 per cent of hay acreage, and that these farmers make higher profits than those having a greater or a smaller acreage.

TABLE XV.—*Percentage of crop area in hay as related to labor income.*

Per cent of crop area in hay	0 to 29.	30 to 39.	40 to 49.	50 to 59.	60+.
Number of farms	33	107	145	74	19
Adjusted labor income	96	93	107	105	72

Average percentage of crop area in hay, 44.

Thus the larger number of farmers, as well as the average of all the farms, falls within the limits of the most profitable acreage. In other words, the farmers here have in a general way, and perhaps without any very definite knowledge that they were right, responded to the economic pressure which tends to drive them in the direction of the greatest profit. The hay crop ordinarily occupies the land for two years in a five-year rotation, but a sufficient number of the farmers leave their hay lands down for a year longer, and occasionally even longer than this, to bring the percentage area of the crop somewhat above the 40 per cent line. It is probable that the substitution of soy beans for oats in the second year of the rotation would obviate the necessity of leaving meadows down for more than two years except for pasture, unless the soys are grown for seed.

We have already seen in Table VIII that hay is the second most important direct source of cash income in this region. While it occupies twice the area of any other crop, a large proportion of the crop is fed. Here again the question arises whether it would pay best to feed all the hay, sell all of it, or feed part and sell part. If the latter, then what proportion of the farm income may legitimately be derived from the sale of hay? Fortunately, the data on this point are such as to give quite a definite answer to the query. During the year to which these records relate 298 of the 378 farms operated by their owners sold some hay. The highest proportion of income from this source on any farm was 57 per cent. The percentages for the different farms are fairly evenly distributed between 1 and about 25 per cent, gradually falling off beyond this point. Table XVI shows quite conclusively that those farmers who derive from 1 to 9 per cent of their income from the sale of hay make higher profits than any others, and that, next to these, those who derive from 10 to 19 per cent make the most profit.

TABLE XVI.—*Relation of labor income to percentage of income from hay.*

Per cent of income from hay	None.	1 to 9.	10 to 19.	20 to 29.	30+.
Number of farms	80	78	114	64	42
Adjusted labor income	78	132	112	98	55

It is clearly indicated here that under the conditions prevailing during the year of the survey the most profitable practice is to grow a little more hay than is needed for feed on the farm. It will be noticed, however, that the number of farmers in the second most profitable group is somewhat larger than in any other. The price of hay, due to a shortage in yield, was rather high during 1911, the average sale price being $22.12. These high prices probably induced a larger number of farmers to sell hay than is ordinarily the case.

Fruit.—Of the 378 farms here under consideration, 315 reported some fruit acreage, the average percentage area being 2.5. On only 10 farms did this acreage exceed 10 per cent. In by far the larger number of cases it was less than 5. Fruit is thus very generally grown, but almost entirely for home use. Commercial fruit growing does not appear to be adapted to the conditions prevailing in this locality. Just why this is the case has not been determined, but it is probable that the character of the soil is the main factor. The topography is also less broken than it is in most of the leading orchard districts, thus giving rather poor air drainage and exposing the early blooming varieties of fruit to danger from untimely spring frosts.

The relation of fruit acreage to labor income is shown in Table XVII. The 63 farmers who reported no fruit trees on their farms made labor incomes 9 per cent below the general average.

TABLE XVII.—*Acres in fruit as related to labor incomes.*

Acres in fruit	None.	1 to 5.	Over 5.
Number of farms	63	306	9
Adjusted labor incomes	91	103	48

Those having 1 to 5 acres of fruit made labor incomes 5 per cent above the average, while the 9 farms having a larger acreage made less than half the average labor income.

While fruit occupied an average of 1.35 acres, or 2.5 per cent of the crop area on each of these farms, the income from the sale of fruit was only seven-tenths of 1 per cent of the total receipts, as shown in Table VIII. In most cases the receipts are only 1 or 2 per cent of the total farm receipts. In only five cases did the percentage exceed 10, the maximum being 28 per cent.

The relation of income from fruit and labor income is shown in Table XVIII. A majority of the farms sold no fruit, but their labor incomes were below the average. A large number derived from 1 to 9 per cent of their income from this source, and made labor incomes 13 per cent above the average.

TABLE XVIII.—*Percentage of income from fruit as related to labor income.*

Per cent of income from fruit	None.	1 to 9.	10 to 19.	20+.
Number of farms	261	112	3	2
Adjusted labor income	95	113	85	88

The numbers in the higher groups are too small to be significant, but in both groups the results are considerably below the average. It is quite probable that if cost accounts were kept with these orchards they would appear to be unprofitable. But the small acreage requires little care, and the time devoted to them is seldom taken from more profitable endeavor. At any rate, the figures, both as to acreage and as to proportion of income, show clearly that on those farms on which fruit constitutes one of the minor enterprises the profits are greater than where it is entirely absent. At the same time they indicate that the proper position of this crop is that of a decidedly minor enterprise. We have here what appears to be a good illustration of the principle that within certain limits it pays well to produce home supplies and to conduct a properly diversified business.

Truck crops.—As previously stated, kitchen gardens were not taken into account in this survey. Other studies, however, have shown that the farmers of this general region almost universally grow a liberal supply of vegetables for home use. Situated as this area is, not far from several large cities, it would naturally be expected to find considerable development of commercial truck growing here. But such is not the case. Only 23 of the 378 farms derived any income from this source. This general region is one in which commercial truck farming is perhaps as highly developed as it is anywhere in this country, but the amount of vegetables grown is so vast that the supply is practically always greater than the demand, except during the early part of the season for each of the various truck crop products. It is therefore only those who can reach the market early who find the business profitable, and to do this requires a light sandy soil that warms up rapidly in the spring and thus conduces to earliness. The soils of this area are in the main heavy, and hence truck crops mature late in the season. Here and there, however, is a farm with more or less warm sandy land, and a few of these are devoted more or less to this type of farming. Some of them deliver their product by wagon to Wilmington, Del., a distance of 15 miles from the center of the survey area. Of the farms conducting a trucking business, only two have more than 20 per cent of their acreage devoted to it.

Twenty-three farms derived a portion of their income from the sale of vegetables. Three of them sold a small quantity of such products from their kitchen gardens and reported no acreage of commercial truck crops. In the case of both acreage and income the number of farms is too small to permit a satisfactory comparison between labor income and magnitude of the trucking business, such as has been made above for other crops. The small number of these farms is itself an indication that the business is not at home here, even if the population to be supplied is very large.

Poultry.—The receipts from poultry and eggs constitute 8.2 per cent of the total receipts of the 378 farms. Only eight of the total number reported no income from this source. From the standpoint of the number of farms, this enterprise, therefore, heads the list of farm enterprises in this locality; that is, it is the most universally found of any farm enterprise. But we have already seen that in very few cases do the flocks exceed 200 hens. Poultry thus constitute one of the more important of the minor enterprises on the farms of this region, as they do so generally in nearly all parts of this country. Do these poultry pay? They furnish a very important part of the family living, but this is not taken into account in this study. The data here given relate only to the commercial phase of the business. If they are profitable, why do not farmers keep larger flocks? These questions are quite definitely answered in the data obtained in this survey, and the answer is one of great importance both to the farmer whose poultry are merely incidental to the general farm business and to the poultryman who makes of them a major enterprise.

Percentages of income from poultry are about equally numerous from 1 per cent up to about 9 per cent. Above this the numbers fall off rapidly. Fifty-one farms derive more than 20 per cent of their income from this source and eight farms more than 40 per cent. Thus, of 370 farms keeping poultry, only 8 would be classed as real poultry farms, while of 347 farms deriving incomes from the sale of dairy products, 157 are classed as real dairy farms, and that, too, without counting income from the sale of cows and calves. Why is the more universal poultry enterprise in nearly all cases a minor one while the somewhat less common dairy enterprise is so frequently the leading source of income? The figures given in Tables XIX and XX show the reason for this to be that when the poultry business is made a minor enterprise it is profitable, while when it rises to the dignity of a major enterprise it often becomes unprofitable or at least much less profitable than when it occupies a minor place on the farm. On the other hand, the dairy business in this region is more profitable as a major than as a minor enterprise.

Unfortunately, the number of farms in two of the classes of Table XIX is quite small, but the very low average labor income in both these classes can hardly be regarded as insignificant.

TABLE XIX.—*Percentage of income from poultry as related to labor income.*

Per cent of income from poultry	None.	1 to 9.	20 to 39.	40+.
Number of farms	8	319	43	8
Adjusted labor income	38	104	97	40

The numbers in the remaining classes are quite sufficient to give averages having a definite meaning. Farmers deriving from 1 to 19 per cent of their income from poultry make profits above the average, while those deriving more than 20 per cent of their income from this source make profits below the average. Furthermore, the largest number of farmers are in the class making the greatest profits. In other words, the farmers of this region have been driven by economic forces, which are not always definitely recognized, to give the poultry enterprise the position on their farms which conduces to the greatest profit. The fact that the forces acting in this case are not universally recognized and understood is proven by the fact that quite a number of farmers have not responded to them.

We shall perhaps find no better illustration than this of the fact that it would not always pay the farmer to do cost accounting, and as a result of the information thus obtained increase the magnitude of his most profitable enterprises and eliminate those which the bookkeeping records indicate to be unprofitable. The Office of Farm Management has kept books on farm poultry under conditions similar to those prevailing on the average farm of this region, and when the time and material devoted to them are charged at current rates the results showed a loss for the year. Doubtless the same would be true on most of these farms. Yet the data given show that they are profitable when kept within proper limits. It is, of course, possible to make a real poultry farm profitable, especially near a good market, and such farms are to be found. But it is difficult to do so. The poultryman finds himself in competition with farm flocks that are kept at nominal expense, both the time and materials consumed in their management being otherwise largely unutilized. The business may thus be distinctly profitable to the farmer with a small flock, while the poultryman under the same conditions would find it much more difficult to make a profit. One or two of the real poultry farmers found in this survey made fair profits, but they were unusual men.

Dairying.—It has been made clear in the foregoing discussion that this is preeminently a dairy region. The receipts from dairy cattle and their products together constitute 44 per cent of the entire income of these 378 farms. It will later be seen that on the tenant farms dairying is even more important than it is on those operated by their owners. For the past third of a century the production of market milk has been the standard type of dairy farming in Chester County. It is by far the most important enterprise found in this survey. The number of farms deriving various percentages of income from dairy products is fairly evenly distributed from about 20 per cent to about 60 per cent of income from this source. Above and below this the farms are less numerous.

The income from cattle is in the main a mere incident to the selling of dairy products, and represents usually the selling of a few calves and discarded cows. There are only nine of these farms which derive more than 20 per cent of their income from the sale of dairy cattle. Six of these are farms on which the income was so small that the few dollars received from the sale of a few calves and a cow or two was the principal income. But the other three are farms which make a business of raising well-bred stock for sale for breeding purposes. These three farms made very good profits. It would appear that there is room here for a much greater development of the pure-bred stock business. In a region so distinctly devoted to a type of live-stock farming as this is, there should be good business for more than 3 out of 378 farms devoted to producing high-class breeding stock for their neighbors. Perhaps the fact that until recently it has been possible here to buy fairly good cows more cheaply than they could be raised in a region of high-priced market milk is largely responsible for the very general absence of the breeding business. More recently the price of cows has advanced. During the year of this survey (1911) the average price paid for cows was $63.84. At this price farmers can afford to raise them even with the high local prices of milk and feed. Since the survey records were taken there has been an increase in the percentage of calves saved.

In order to keep up a herd of dairy cows, both in numbers and in quality, it is necessary to replace an average of about 25 per cent of them annually. Of these 378 farms an average of 23 per cent were actually replaced, 8.2 per cent by cows raised on the farm, the remainder by purchase. Thus, about one-third of the cows necessary to maintain the herds are raised. It is to be presumed that as the proportion of cows raised increases, which seems likely to be the case with the high prices now prevailing, the number of pure-bred herds will increase in number. Partly because of the general dependence on purchased cows, there is less uniformity of breeds on individual farms in this region than might be expected where more of the cows are raised.

It has been shown in the foregoing pages that in the case of most of the enterprises found on these farms there appears to be a particular status which each enterprise should occupy for best results.

When one of these enterprises is given a magnitude greater or smaller than this the farm profits become less. This does not appear to be the case with the dairy enterprise on the average farm. Table XX shows that the average labor income of each group of farms deriving 20 per cent to 90 per cent of their income from dairy products is above the general average of the community.

TABLE XX.—*Percentage of income from dairy products as related to labor income.*

Per cent of income from dairy products	None.	1 to 9.	10 to 19.	20 to 29.	30 to 39.	40 to 49.	50 to 59.	60 to 69.	70 to 79.	80 to 89.	90+
Number of farms	31	26	26	65	73	71	47	19	11	7	2
Adjusted labor income	43	94	82	114	103	109	102	130	103	101	55

It is considerably lower on those farms deriving less than 20 per cent of their income from this source. These figures indicate that under the conditions prevailing in this region the dairy business may be made profitable whatever position it may occupy on the farm, provided, of course, the cows be of good quality. This is the only enterprise in this region of which this is true.

It is to be inferred from these results that if the cows are of high quality it is relatively unimportant whether the farmer has several other more or less important sources of income. With cows of poor or ordinary quality it becomes increasingly important that the business be diversified; that is, that other sources of income be provided. This conclusion is strongly reinforced by the results given in Table XLIV, in which it is shown that with cows producing less than $50 worth of product annually the larger the herd the less the profit, while with cows producing more than $100 worth of product the larger the herd the greater the profit.

The failure of Table XX to show a particular percentage of income from dairy products to be more profitable than any other may be due to the fact that the quality of the cows on the various farms is highly variable, and, as will be shown later, the producing capacity of the cows is one of the very most important factors of profit on these farms. If the labor income could be further adjusted so as to eliminate the effect of variation in quality of cows, it might be found that there is an optimum status of the dairy industry here. It is also practically certain that if all the cows were as good as the best the most profitable percentage of income from this source would be higher than if the cows were all of poor or medium quality.

Types of dairying.—Table XXI shows the relative importance of the various types of dairying in the Chester County survey area. The farms here represented as selling creamery milk differ from those selling market milk only in the fact that during the summer time, when there is a superabundance of market milk, these farms sell to local creameries.

TABLE XXI.—*Relative importance of different types of dairying, Chester County owners.*

Types.	Number of farms selling only one dairy product.	Total number of farms selling.[a]
Butter making[b]	54	62
Creamery and market milk	204	209
Market milk	74	77
Condensary milk	6	6
Nursery	1	1
Buttermilk		1
Total	339	356

[a] There are 8 farms selling more than one form of dairy product; 4, butter and creamery milk; 2, butter and market milk; 1, butter, creamery milk, and market milk; 1, butter, skim milk and buttermilk.

[b] Butter making is confined principally to farms having too small a quantity of milk to justify delivery at a creamery or shipping station. (See Table XXII.)

Practically all of those farms here listed as "creamery and market milk" farms are really market-milk farms doing business for a portion of the summer season with the creameries. In all there are 209 farms following this practice, while 77 produce market milk, but do not patronize the creameries. There are 62 farms that make some butter, and 54 of these sell no other dairy product. Six farms sell all their milk to a condensary, one makes a specialty of nursery milk for children, and one sells some buttermilk. There is some duplication of farms in the last column of Table XXI. Several of these farms sell more than one kind of dairy products. This duplication is eliminated in the preceding column, which shows the number of farms selling only the one kind of product mentioned.

As previously stated, butter making was formerly an important feature of the dairy business is this locality, and continued as such until the development of the market-milk business, which began about 45 years ago. At the present time butter making on the farm occupies a very subordinate position. It is confined almost wholly to those farms having only a few cows, and hence not enough milk to justify daily delivery at a shipping point. There are also a few farms having a special trade in fancy butter. Table XXII shows that of those farms having 6 cows or less, 38 per cent sell some butter. Of those having more than 6 and not more than 18 cows, only about 6 or 7 per cent sell any butter. Those with more than 18 cows sell no butter.

TABLE XXII.—*Relation of number of cows to butter making.*

Number of cows.	Number of farms.	Per cent of farms selling butter.	Per cent of farms selling dairy products in other forms.	Per cent of farms selling no dairy products.
6 and less	123	38.2	39	22.8
6.1 to 12	122	5.7	92.6	1.7
12.1 to 18	71	7.0	91.6	1.4
18.1 to 24	39	....	100	....
Over 24	23	....	100	....

Table XXIII indicates that those farmers who sell milk during the summer season to creameries make more profit than those who ship to wholesale milkmen the year round. Thus, of the 60 farms 61 to 80 acres in size, 65 per cent sell some milk to creameries in the summer time, while 18.3 per cent ship market milk the year round. The labor income of those who sell milk to the creameries averages $804, while that of the exclusive market milkmen is only $612, or about 24 per cent less than that of the men who sell some creamery milk.

TABLE XXIII.—*Relative profitableness of creamery milk and market milk in Chester County.*

Size groups .... acres	61 to 80.	121 to 160.
Number of farms	60	61
Per cent selling creamery milk	65.0	65.6
Per cent selling market milk	18.3	18.2
Labor income of those selling creamery milk	$804	$1,267
Labor income of those selling market milk	$612	$1,010
Difference	$192	$257
Per cent of larger income	23.8	20.3

A very similar result is shown for the 61 farms in the 121 to 160 acre group. The same proportion of men sell part of their milk to creameries, the same proportion sell only market milk, and the labor income of the latter is 20 per cent less than that of the former.

There are probably two reasons for this difference in the profits made by these two groups of men. In the first place, those who are so situated as to be able to patronize the creameries get approximately as much for their cream as they would for whole milk, and have their skim milk left as feed for calves, poultry, and pigs. In the second place, it is probable that those who sell creamery milk do more summer dairying than those who sell only market milk, and on account of the very excellent pastures in this locality their cost of production averages lower than it does on farms that do more winter dairying.

Beef cattle.—A few farms were found in this survey on which a number of cows of no particular breed, but mostly of dairy blood, were kept but not milked. They were utlized to raise a number of veal calves. The owners called these beef cattle. These farms were operated by men who had no help. The labor incomes on all of them were very unsatisfactory.

Twenty-seven farms were found on which steers were fed. The percentage of receipts from steers on each of the 27 farms exceeds 20 on only 10 farms and 40 on 2 farms. Steer feeding is thus a business little followed in this section. This of itself is an indication that conditions are not generally favorable to the steer-feeding business, especially when it is remembered that in the early days this was a leading industry in Chester County. Its absence is not merely due to lack of knowledge of the business, but to lack of economic conditions favoring it. We have also seen that in the main this business tends to gravitate to the larger farms. It appears especially on those farms that are somewhat too large for one-man dairy farms, and again more commonly on farms too large for two-man dairy farms. It is an extensive system of farming. Ordinarily the profits from it are so small that the small farmer can not well make a living at it. It appears, however, to be a fairly satisfactory business on large farms in this area.

The relation between steer feeding and the resulting labor incomes is shown in Table XXIV:

TABLE XXIV.—*Percentage of income from steers as related to labor income.*

Per cent of income from steers	None.	1 to 19.	20+.
Number of farms	351	17	10
Adjusted labor income	101	94	86

Three hundred and fifty-one of the farms fed no steers and made profits slightly greater than the average. The 17 farms deriving from 1 to 19 per cent of their income from steers made labor incomes 6 per cent below the average. The 10 farms deriving a larger share of income from this source made labor incomes 14 per cent below the average. These results, though based on rather meager data, are consistent with those found in other surveys where small farms are the rule.

Sheep.—As previously stated, sheep were found on only 14 of these farms. Six of them had flocks of breeding ewes numbering from 35 to 55 head. The others had only a few head each. The numbers are too small to give very significant results in a comparison of labor incomes on farms with and without sheep, but this fact of itself indicates that these animals are poorly adapted to the conditions prevailing here. The 364 farms having no sheep made labor incomes 1 per cent above the average. Twelve farms deriving 1 to 19 per cent of their income from sheep made labor incomes 26 per cent below, and the 2 farms deriving a greater portion of income from them made labor incomes 39 per cent below the average. As has already been stated, sheep represent a form of extensive farming which, in this region as elsewhere, tends to gravitate toward the larger farms.

In regions where the farms are not heavily stocked with animals that are capable of consuming the coarse roughage and the natural growth that would go to waste on various parts of the farm, it would probably pay to keep a small flock of sheep as scavengers. So long as their feed consists largely of such materials they should be profitable. Small numbers of sheep may be moved about the farm in such a way as to avoid largely the danger of infection from parasites. When large numbers are kept the battle against parasites becomes a severe one. Generally speaking, the eastern farmer can not compete with the western ranges and those of the Appalachian Mountain country in raising sheep. The winter feeding of lambs is a different business. No examples of it were found in this area. It is too far removed from the source of supply of feeders. Most of the farms are also too small to make this business satisfactory. The profits are too small for the small farmer.

Swine.—In the days before the development of the dairy industry here, and during the early history of dairying, when butter making was its prominent feature, swine occupied an important position in the agriculture of Chester County. The Chester White breed of swine originated here and took its name from that of the county. Since the decline of butter making swine have assumed a minor place in the local agriculture, though they are quite generally kept in small numbers as a means of producing home supplies. About half the farms analyzed in this survey sold a small quantity of pork products. Five of them derived from 20 to 30 per cent of their income from this source and 24 others from 10 to 20 per cent. On the face of the returns those farms deriving part of their income from swine made greater profits than those that did not, but the data are not sufficiently extensive to demonstrate that hogs are more profitable here than the local farmers generally consider them to be. So far as they go, the indications are that it would pay these farmers to give more attention to swine.

Most profitable combination of enterprises.—From the foregoing discussion it appears that dairying may occupy almost any status in this region from that of furnishing about one-fourth of the income to that of almost the sole source of income, the latter especially if the cows are of high quality and the farm is well stocked with them.

Of the remaining enterprises, the most profitable status appears to be approximately as follows: Corn should occupy all the first year and a good part, if not all, of the second year of the rotation, and most of the crop should be fed. Oats should be entirely eliminated, and their place should be taken by an annual hay crop. This crop may occupy a part of the second year of the rotation with corn and potatoes, or if corn occupies all of the first and second years, it may occupy the third year, along with the potatoes. The proper position of the potato crop is not revealed in these studies, for the reason that the price was abnormally high the year the data were taken. It is probable that the status they now occupy is approximately what it should be. Especially on the smaller farms they help to fill the labor schedule. Wheat should occupy one year in the rotation and hay two years. Most of the hay should be fed, but especially on the larger farms a good deal of it may be sold with profit. Fruit should be grown as a means of producing home supplies, and a small amount may be grown for sale. Beyond this it does not seem advisable to go into the matter of fruit culture.

Apparently the farmer of this locality should give somewhat more attention to swine, especially as a means of producing home supplies, but also as a minor source of income. Each farm should keep a flock of hens, usually not less than 50, nor more than 150 or 200. The exceptional man, especially if his farm is small, may give this enterprise more attention than this. Steer feeding should, in the main, be confined to farms that are not adapted to the dairy business, usually for lack of suitable labor, and should ordinarily be confined to farms of considerable size. The same is true of sheep. They do not appear to be so well adapted to the conditions prevailing here as steers. It is only the large farmer who can hope to make a satisfactory profit from them in this region.

The farmer who has a large herd of exceptionally good cows can afford to give less attention to other sources of income. But as the quality of the cows decreases their number should also decrease, and the farmer should depend more and more on other sources of income. Thus he might sell more hay and corn, keep a few more hens, give more attention to hogs, etc.

The importance of the dairy cow in this region renders it highly important that the farmers give more attention to improvement in the quality of their cows. This can hardly be done so long as the major portion of the cows are bought, for cows of the best quality are usually not for sale, and even when they are the price is so high that the farmer will find it more profitable to raise them. This subject is further discussed in connection with quality of the farm business later in this bulletin.

Résumé of conditions affecting types of farming.—In the preceding pages we have found that on by far the greater number of farms in this region dairying is the major enterprise, with hay, wheat, and poultry of considerable importance, while potatoes, hogs, and corn constitute considerable, though less important, sources of direct income. Fruit is the only other enterprise generally found on these farms, and in nearly all cases it is a very small enterprise, designed principally for the production of home supplies. We have also found that the sources of income on these Chester County farms differ radically from those in certain other sections of the country. While some of these differences may be due merely to local customs inherited from the preceding generation of farmers, there are also deeper underlying causes.

The principal factors which determine the distribution of farm enterprises are climate, soil, and local conditions with reference to market demands, market prices, and the character and amount of the available supply of labor. These are the factors which, in general, determine whether or not a given enterprise is adapted to a specific locality, but it does not at all follow that because an enterprise is adapted to the conditions prevailing generally in a region it is adapted to every farm in that region, for the business conditions on individual farms may make neighboring farms adapted to quite different types of farming. We have already seen that some of the types of farming found in Chester County can be made quite successful if the farm is large enough. This is especially true of steer feeding. In some localities the distance to a shipping point may have considerable effect on the types of enterprises which each individual farmer should select. The amount of labor available to the farmer, the amount of capital at his disposal, and the character and amount of the equipment already on the farm also have an important influence in determining the enterprises which the individual farmer should attempt to maintain. Unless, therefore, the conditions which determine what enterprises are adapted to the region as a whole limit the profitable enterprises to a very small number, we should expect to find considerable diversity in types of farming. In Chester County the enterprises adapted to the general region are comparatively few in number, though more numerous than is the case in some other sections of this country. It happens also that the one enterprise which seems best at home here, namely, dairying, can be successfully conducted, if right methods are used, on farms varying greatly in size. For these reasons we find greater uniformity in the type of farming in this locality than is generally the case in most parts of the country. There is considerable diversity in the local agriculture, but it is a diversity which is characteristic of the individual farm and does not in general result in classes of farms devoted to different types of farming.

Table XXV gives the list of enterprises which are of any importance in this region, together with the factors which are favorable and those which are unfavorable to each. This table is almost self-explanatory. It will be noted that dairying is handicapped by but one unfavorable condition and that one which can be neutralized by breeding up the dairy herds to meet the high price of hay and grain with a maximum milk production.

TABLE XXV.—*Some favorable and unfavorable conditions affecting types of farming, Chester County.*

Enterprises.	Favorable conditions.	Unfavorable conditions.
Dairy	Good markets; excellent pastures; corn; hay; size of farms; character of labor; gives winter employment.	High price of hay and grain.
Hay	High prices; usefulness as feed; soil; climate.	Short season of employment.
Potatoes	Nearness to markets; climate favorable; distributes labor.	Prices variable; low yields; soil.
Wheat	Soil; nurse crop for grasses; seasonal distribution of labor; furnishes bedding.	Small farms; western competition; small profit per acre.
Poultry	Excellent markets; soil; climate; production of home supplies; utilization of spare time and waste materials.	Competition from small flocks everywhere.
Hothouse products	Nearby great city; provide winter work.	Diseases; danger of overproduction.
Hogs	Good market; pastures	High price of concentrates; danger from cholera; competition with dairying; lack of skim milk.
Corn	Good market; usefulness as feed; soil; climate.	Furnishes no profitable employment from July to late September.
Truck crops	Good market; home supplies	Competition of near-by soils better adapted.
Fruit	do	Soil (?); topography (?); fluctuation of production and prices.
Beef cattle	Good market; crops; pastures; climate.	High price of feed; smallness of farms; competition with dairying.
Sheep	do	High price of feed; smallness of farms; parasites; dogs; competition with dairying; small per cent of nonarable land.
Oats	Value as feed	Climate; small value per acre; poor nurse crop.

Relation of type of farming to distance to market.—The region of this survey is so well provided with transportation facilities that none of the farms is located more than 5 miles from a possible shipping point. A tabulation of the various types of farming and their relative frequency at different distances from shipping points shows practically no relations existing in this territory between the two. There are localities, however, in which many farms are located at great distances from a shipping point, and in which this fact becomes an important factor in determining the enterprise best suited to individual farms.

Special farms.—As previously stated, 27 of the owner farms found in this survey were either wholly or partly devoted to the production of hothouse products, mainly mushrooms. A few farms produced hothouse tomatoes, and two of them derived a large per cent of their income from carnations. For the year of this survey (1911) these special farms made very satisfactory profits, considerably larger than farms of other types in this region, but it would be ruinous from the standpoint of profits for the farmers of this region generally to undertake a hothouse business. Overproduction would be inevitable.

The data obtained about the details of the hothouse business in this locality were not sufficient to permit a more detailed consideration of these special farms in this bulletin.

MAGNITUDE OF THE FARM BUSINESS.

The magnitude of the farm business may be measured in a number of ways. In comparing farms where the land is of similar character and of the same price per acre, the magnitude of the farm business is quite closely proportional to the sum of the interest on the capital invested, current expenses, depreciation, and wages for the operator. But this method would not be accurate in dealing with farms on which the land differs widely in price but not in yielding power. If the land is very high priced, a given amount of business might require a very large amount of capital, while with low-priced land the same amount of business will require much less capital.

In most farm-management surveys the land of the different farms included is at least comparable in price, or where this is not the case the differences in many cases are due to difference in the real value of the land for farm purposes. Under such conditions it is fairly easy to establish a basis on which to measure the magnitude of the farm business. The problem is much more difficult when a comparison is to be made between farms in different regions in which the economic conditions, especially land prices, are widely different.

In dealing with the farms of a limited region where the various types of farming do not differ markedly in the amount of labor required in comparison with other expenses, perhaps the most accurate measure of magnitude is the sum of the area in crops and the crop area equivalent of the area in pasture. But it is not always easy to determine how many acres of pasture are equivalent to one acre of field crops from the standpoint of feed produced. If the comparison to be made, however, includes farms on which the percentage of pasture land varies widely, it is necessary to use some such basis as that just mentioned in order to get a fair comparison of magnitude.

In the area here under consideration the proportion of land in pasture, especially when the farms are considered in groups, varies within narrow limits. In such cases the area in crops alone gives a fairly satisfactory measure of magnitude, since it is proportional to the sum of the crop and pasture area.

In many localities a considerable proportion of every farm is made up of rough land, frequently occupied by timber, and in such regions the proportion of the farm thus occupied may vary greatly. In such a case it is evident that the size of the farm—that is, the number of acres in the whole farm—is utterly useless as a measure of the size of the farm business. In these cases it would be better to use the crop area plus the crop equivalent of the pasture area. By referring to Table II it will be seen that when the farms in this survey are averaged in groups the total woodland and waste land varies within narrow limits. Hence in this Chester County area the size of the farm itself is very closely proportional to the magnitude of the farm business. For this reason it has been used in this bulletin in the tabulations which involve the relation of the magnitude of the farm business to other factors. This method, as above stated, would not be applicable to a region in which a large and variable proportion of the land is practically unused in the business.

THE MINIMUM EFFICIENT UNIT.

The "minimum efficient unit" in agriculture is a farm of sufficient size and so organized as to give full employment at productive labor to the farm family. The farm may be any amount larger than this, provided the operator has sufficient managerial ability to make the larger business efficient, but there are very distinct disadvantages if the farm business is smaller than the most efficient unit as above described. When such is the case the farm family does not have the opportunity to exert its full earning power.

The fact that the minimum efficient unit in farming is relatively very small as compared with most other industries is the most attractive feature of farming as a business. Because of the small size of this unit economic independence is fairly easy of accomplishment, and many prefer independence with a moderate competence to dependence with a very small chance of pronounced success.

The ideal size of farm is somewhat larger than the minimum efficient unit. It is such as to permit a high standard of living and the education of the farm children, but the ordinary family farm with good management will often permit this.

Farms in the North Atlantic States are mostly small in area. The reason for this is mainly historical and has already been set forth in the introduction to this bulletin. Attention has also been called to the fact that in increasing the farm business on these small farms in order to meet the competition with larger farms in the West, the line of least resistance was represented by the development of more intensive farming rather than extension of acreage, though examples of both methods of enlarging the business are frequently found. It requires somewhat greater ability on the part of the farmer to conduct an intensive business on a small area than it does a more extensive business of similar magnitude on a larger area. Hence, a large proportion of eastern farmers with small areas of land at their disposal have not been as successful as might be wished in developing a business of suitable magnitude. There are still very many eastern farms that are far too small for satisfactory results. In this survey, of the 378 farms conducted by their owners 54 of them were from 13 to 40 acres in area. The average labor income made by these 54 farmers was only $240, which is considerably less than ordinary farm wages. (See Table XXVI.)

Just the opposite condition is found in the corn belt. There magnitude of business is obtained by extent of acreage, and large farms are the rule, small ones being the exception. Since there is ample demand for the principal products of intensive farming in the region of Chester County, it is perhaps fortunate that the average size of farm is such as to require at least a considerable degree of intensity in the farming. The relatively small farm makes it possible to maintain better schools and a more satisfactory social life in the country, but this applies only to farms of moderate size in this area. A large number of farms are too small to permit satisfactory profits to the owners.

RELATION OF SIZE OF FARM TO LABOR INCOME.

The relation of size of farm to labor income is shown in Table XXVI. The farms 13 to 40 acres in size, averaging 28 acres, are 54 in number, with an average labor income of $240 per year. This represents what the farmer himself gets for his labor and managerial ability, the value of the unpaid family labor having already been accounted for as a part of the expenses of the business.

Table XXVI.—*Relation of size of farm to labor income on 378 farms operated by owners in Chester County.*

Size of farms, in acres.	Number of farms.	Average size.	Average labor income.	Per cent of farms with labor income $1,000 or more.
		Acres.		
13 to 40	54	28	$240	6
41 to 60	61	52	550	10
61 to 80	60	73	730	25
81 to 100	68	93	848	34
101 to 120	52	110	937	46
121 to 160	61	136	1,094	46
161 to 393	22	203	1,575	68
Average	378	90	789	30

A good many of these farmers found it necessary to obtain a considerable proportion of their income from work outside the farm. In addition to this, the farm family has what the farm furnishes toward the family living, and interest on the capital invested. Only three of the 54, or about 6 per cent of the whole, made labor incomes in excess of $1,000. The next group of farms, consisting of those from 41 to 60 acres in area, and averaging 52 acres, contains 61 farms. The labor income was, on the average, $550. Ten per cent of these farmers had labor incomes over $1,000. There were 60 farms of 61 to 80 acres in area, averaging 73 acres, and having an average labor income of $730. Twenty-five per cent of this group made labor incomes over $1,000. In the 81 to 100 acre groups 68 farms, averaging 93 acres in area, produced an average labor income of $848, 34 per cent of them being over $1,000. Of the 52 farms in the 101 to 120 acre group, averaging 110 acres, the owners made an average labor income of $937, 46 per cent of them being above $1,000. Above this acreage the number of farms falls off rapidly, and in order to secure a number of farms comparable with those in the preceding groups it was necessary to broaden the size limits of the group to 40 acres. This gives 61 farms of 121 to 160 acres, averaging 136. The average labor income was $1,094. Here, again, 46 per cent of the farmers earned over $1,000 each. There were only 22 farms of more than 160 acres, the largest being 393 acres. The average area of the 22 farms is 203 acres and the average labor income of the owners $1,575. Sixty-eight per cent of these large-farm owners made labor incomes in excess of $1,000. We have here a very conclusive demonstration of one of the fundamental principles of farm management, and that is that one of the most important factors of efficiency in farming is the magnitude of the farm business.

The prevalent style of farm organization in this region is such that the magnitude of the business conducted on a given area is considerably larger than on a similar area in most sections of the Middle West, so that the labor incomes obtained here on farms, say of 40 to 80 acres, are comparable with those obtained on considerably larger farms in regions where the farming is less intensive. While only 10 per cent of the farmers of the 41 to 60 acre group made more than $1,000 labor income, the average of this group was $550, which is fairly satisfactory when it is remembered that in addition to this labor income the family has the interest on its investment and whatever the farm furnishes toward the family living. Such an income will permit a very satisfactory standard of living, but it must be remembered that it is more difficult to make a good living on a farm of this size even in this region than it is on a larger farm, and when we come to consider tenant farming here we shall see that tenants, as a rule, avoid the small farms. *Below 40 acres the difficulties of success with the type of farming most prevalent in this region, namely, dairying, are so great that only one man in sixteen was able to make over $1,000 a year for his labor.* These farms are unquestionably too small for the average man following this type of farming. It is only when the size of farm reaches 121 to 160 acres that the *average* farmer is able to make a labor income above $1,000. In our work we must deal primarily with the average farmer and state the conditions under which he can be successful. The unusual man can succeed under much more difficult conditions.

Figure 8 shows the relation between labor income and size of farm in graphic form. The points of the broken line in this figure represent the average size of farm in each of the groups shown in Table XXVI and the average labor income made by each of these groups of farmers. Size of farm is shown at the bottom of the figure and labor income in the left margin. The broken line shows even more clearly than the figures of Table XXVI that as the size of farm increases the average labor income increases, and within the limits of the sizes found in this survey the increase in labor income keeps pace with increase in area. If the larger farms were devoted to distinctly different types of farming from the small farms, or if there were many farms so large that their owners could not manage them efficiently, there would probably be a different story to tell.

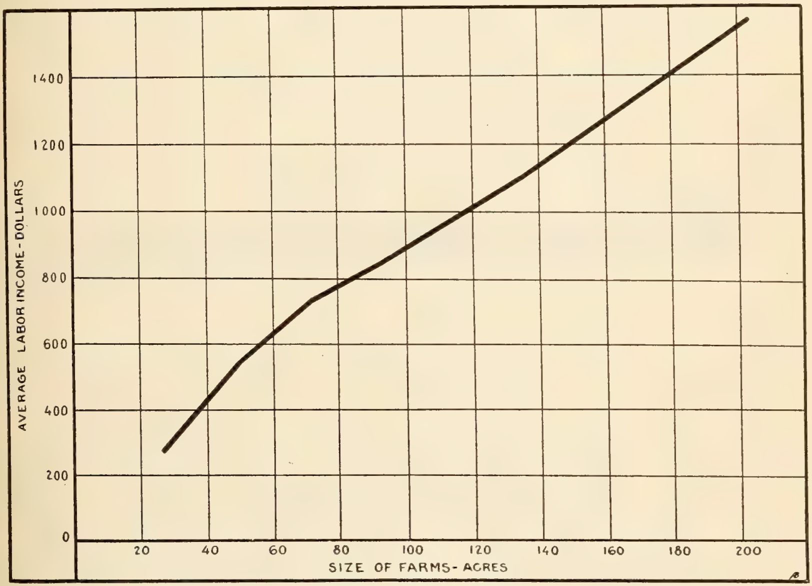

FIG. 8.—Relation of size of farm (area) to labor income; 378 owner farms.

Figure 9 shows quite clearly that size of farm is not the only factor of efficiency in farming. In this figure the labor income of every one of the 378 farms is shown individually. Each of the 378 vertical lines represents the labor income of a particular farm as measured on the scale at the left of the diagram, the highest labor income being approximately $3,700 on a farm of about 175 acres. In this diagram the farms are arranged according to size, the smallest being at the right and the largest at the left of the diagram. The line running clear across the lower part of the diagram shows approximately the size of each farm as measured on the scale of acres shown at the left. The largest farm was 393 acres and the smallest 13 acres. The first farm to reach a labor income of more than $1,000 was a farm of about 37 acres. It was an intensive dairy farm conducted by a very efficient owner. The first farm to reach a labor income of more than $2,000 was one of 80 acres and of similar type to the smaller farm just mentioned. The first to reach $3,000 was a farm of 120 acres, which was also a dairy farm, but quite diversified in character, having several other important enterprises. Quite a number of minus labor incomes are shown, represented by the vertical columns projecting downward from the zero line of labor incomes. The largest minus labor income was found on a farm of more than 100 acres and the next largest on a farm of about 120 acres. Thus a large farm presents the possibility of large losses as well as large profits. Size of farm, then, is not sufficient; the farm must be properly organized and efficiently managed and must be devoted to types of farming that are suited to the locality and to the business conditions on the farm. The largest minus labor income shown on this diagram was due to a serious error in the selection of the type of farming.

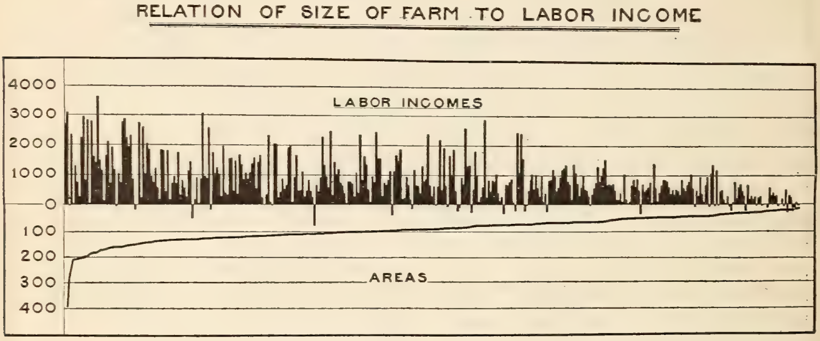

FIG. 9.—Labor income and area of each of the 378 farms operated by their owners.

It will be noticed that many minus labor incomes are shown on the very small farms at the right of the diagram in figure 9. The next largest number of minus labor incomes is found just to the right of the middle of the diagram, on farms of about 70 to 90 acres. These farms were of proper size for a good two-man dairy farm, but for some reason they were not organized in this manner and were consequently not efficient, but some of the most efficient farms found, taking their size into consideration, belong in this group. It will be noticed that there are distinct stages in the increase of the highest labor incomes as we proceed from the small to the large farms in this diagram. The first marked increase occurs at about 35 acres. Beyond this there is not much change in the maximum labor incomes until we reach about 75 or 80 acres, though the *number of farmers making good incomes* is greater on the average as the size of the farm increases. The 40 to 50 acre dairy farm here represents the efficient size of a one-man farm. From this up to about 75 acres the farms are not large enough for full-sized two-man farms, unless organized and equipped with a good deal of skill. Yet they are too large for one-man farms. A good many of the farms of this size were equipped with two-man outfits, which were not fully utilized. Others were equipped with one-man outfits which could not conduct the business efficiently. This accounts for the fact that a few well-organized and well-conducted farms of about 35 to 40 acres in size were approximately as efficient as any of the farms until we reach about 80 acres. At this point we reach the efficient size two-man farm, and immediately we begin to find farms with much larger labor incomes. Above this we have a group of farms somewhat too large for efficient operation on a two-man basis and somewhat too small for efficient operation on a three-man basis. While the proportion of successful farmers is larger in the upper portion of these limits, there are individual farms around 80 acres which have larger labor incomes than any other farms within the limits here under consideration.

The results shown in figure 9 demonstrate that we must use care in interpreting averages in farm-management surveys. There are other factors which may, in special cases, become more important than magnitude of business. The average labor income of the entire 378 farms operated by their owners is $789. This is considerably larger than the average labor incomes found in most of our surveys. This, however, does not necessarily mean that the farmers of this locality have better incomes than those elsewhere. The labor income is what is left of the net income of the farm after allowance has been made for interest on the capital invested in the business. The rate of interest used in making these calculations was 5 per cent, which rate is approximately the prevailing rate for well-secured farm loans. But one reason for using this rate was to make it possible to compare the average labor income of farmers in this region with those of others in which this same rate was used.

There is a very distinct tendency for the price of farm property, especially real estate, to rise to such a point as to absorb all the profits in farming except the wages of the operator. The higher labor incomes found in Chester County simply indicate that the farmers of this region had not at the time of this survey (1911–12) fully capitalized the earning power of their property. Under such conditions it is impossible to buy land at the prevailing prices with some degree of certainty that it can be made profitable. As previously stated, the price of farm land has risen materially in this locality since the survey was made. Unless there has been a corresponding increase in the price of farm products, which is very doubtful, a repetition of this survey would therefore show a decrease in labor incomes, because a larger proportion of the profits would be absorbed by interest on the investment.

RELATION OF SIZE OF FARM TO EFFICIENCY.

In Table XXVII some of the reasons are given why it is easier to make a satisfactory income on a large farm than on a small one. Let us consider first the number of productive work units per farm. On many farms a great deal of the work is devoted to things which add little or nothing to the profits of the business. By productive work we mean work applied to an enterprise which constitutes a source of income, and by a work unit we mean an average day's work of a man or a beast.

TABLE XXVII.—*Relation of size of farm to efficient use of labor and working capital, Chester County owners.*

Sizes of farms, in acres.	Number of farms.	Productive work units per farm.		Crop acres per man.	Man labor per crop acre.	Value of labor per month per man.	Crop acres per work horse.	Work horses per man.	Value of machinery per crop acre.	Ratio of cost of buildings to farm income.	
		Man.	Horse.							Dwelling.	Other buildings.
13 to 40	54	184	82	13.7	$20.74	$23.93	9.0	1.5	$15.11	3.41	2.78
41 to 60	61	299	140	20.2	15.78	26.60	11.9	1.7	12.57	2.19	1.91
61 to 80	60	372	177	23.2	13.98	27.12	13.9	1.7	11.92	1.88	1.89
81 to 100	68	475	226	25.2	13.46	28.30	14.5	1.7	10.79	1.76	2.03
101 to 120	52	551	259	25.6	13.64	29.22	15.0	1.6	11.80	1.83	1.92
121 to 160	61	582	286	29.0	11.80	28.50	16.8	1.7	9.20	1.62	1.83
160+	22	856	444	31.1	13.05	33.77	17.4	1.8	8.94	1.68	1.91
All sizes	378	439	211	24.7	13.69	28.27	14.7	1.7	10.88	1.88	1.96

The 54 farms of 40 acres or less furnish their owners on the average 184 productive man-work units and 82 productive horse-work units a year. A man who works at profitable employment only 184 days in the year does not get a good income unless he is a man of unusual ability. These farms are too small to give a sufficient amount of labor with the style of organization which prevails on them. If the region were one which permitted still more intensive farming, these farms might permit a satisfactory business. The third and fourth columns of Table XXVII show that as the farms increase in size the amount of labor the farm provides increases markedly. In the case of the 22 farms of more than 160 acres we have an average of 856 man-work units and 444 horse-work units. It will be noticed that in all the groups the number of productive horse-work units is about half those of the productive man units. On the average for the whole number of farms there are 439 man and 211 horse work units. This increase in the number of productive work units with increasing size of farm is perhaps the principal reason for the average increase in labor income.

Not only does the large farm furnish a larger amount of profitable labor, but it is easier for the owner to secure more efficient use of labor on the larger farms. That is, he does not have to exert himself so much to find profitable employment for himself and the labor available to him. This is shown in the fifth column of Table XXVII, under the heading "Crop acres per man." Although these farms are all organized in approximately the same manner and, on the whole, are conducted in much the same way, the number of crop acres per man in the group of smallest farms is only 13.7, while on the largest farms it is 31.1 acres, there being a general increase in acres per man with increase in size of farm. On the larger farms the laborers devoted a greater proportion of their time to really profitable employment. This is another reason why the large farm is easier to make profitable than the small one.

The next column of the table, headed "Man labor per crop acre," shows much the same thing, though from a different viewpoint. On the first group of farms—that is, the very small farms—the whole amount of man labor done on the farm costs $20.74 for every acre of crops grown. This includes all the labor of the farm, not merely the crop labor. As the size of farm increases the amount of the total farm labor per acre of crops gradually decreases until in the next to the last group it amounts to only $11.80 per crop acre. In the next group it is somewhat larger, these very large farms—that is, for this region—perhaps being somewhat less efficiently managed than the farms somewhat smaller. This column merely shows that on the larger farms the labor is more efficiently applied. The next column, headed "Value of labor per month per man," shows that the larger the farm the more the farmer can afford to pay in wages. The figures in this column are based on wages actually paid and the farmer's estimate of the value of his own labor and that of the unpaid members of his family. The larger farms are able to pay higher wages and, at the same time, make greater profits. The next column shows the crop acres per work horse. Here again we have a great increase in efficiency of work horses as the size of the farm increases, the number of crop acres per work horse being approximately twice as great in the last group as in the first. The column headed "Work horses per man" shows again that the man labor on the larger farms is more efficient than it is on the smaller, the average number of work horses per man increasing with the size of the farm.

When it comes to the matter of expenses the large farms again have the advantage, as shown in the column headed "Value of machinery per crop acre." We shall see later that the small farms are not as adequately equipped with labor-saving machinery as the large farms. Nevertheless, the necessities of the case require that the expenditure for machinery be nearly twice as much per acre of crops on the smallest farms as on the largest, and there is an almost regular decrease in the value of machinery per acre as the size of the farm increases. A similar state of affairs is shown in the last two columns of the table. On the very small farms the average value of the farm dwellings is 3.41 times, while on the largest farms it is only 1.68 times the net farm income. Similarly, the cost of other buildings is relatively very much larger on the small farms than it is on the large ones, as shown when the value of the buildings is measured in terms of the net farm income. The cost of farm buildings in this area is considerably higher than it is in many other sections of the country. This is due mainly to the fact that farm structures are more substantially built here than is customary in more newly settled sections. It is doubtful, however, in view of the very substantial construction of these buildings, whether the annual cost of maintenance for farm buildings is much, if any, larger than it is in the Middle West, where the buildings cost less but are less substantially built. The amount of money the farmer can afford to put into a building depends in part on the length of time it will last. It may be, therefore, just as cheap in the long run to build a very substantial building that will last a century as to build a much cheaper one that will last only 30 years. While the interest charges are greater on the more expensive building, the depreciation and repairs may be much less. This is a problem which has not yet been worked out fully. We do not know just what proportion of the farmer's income he is justified in putting into farm buildings, though this is one of the important problems under investigation.

Table XXVIII shows another reason why small farms are more difficult to make profitable than large ones. This table shows the annual repair and interest charges on machinery and buildings and the repair charges on fences on farms of different size. In the last column of the table these expenses are combined and reduced to an acre basis.

TABLE XXVIII.—*Relation of size of farm to yearly interest and repair charges on machinery, buildings, and fences on 378 owner farms, Chester County.*

Size of farm, in acres.	Cost per farm.								Cost per acre.
	Machinery.			Buildings.			Fence repairs.	Total per farm.	
	Repairs.	Interest.	Total.	Repairs.	Interest.	Total.			
60 and less	$9	$18	$27	$11	$162	$173	$6	$206	$5.81
61 to 100	14	29	43	11	248	259	8	310	5.80
101 to 160	21	37	58	16	308	324	14	396	4.54
Over 160	41	53	94	3	493	496	18	608	4.31
Average	16	30	46	12	254	266	10	322	5.08

The total expense per acre for these purposes is seen to be $5.81 on the smallest farms and grows gradually less as the size of the farm increases, and on the largest farms it is only $4.31.

This matter of the relation of the size of the farm to the ease of making a satisfactory profit has been dwelt upon at considerable length in these pages because of the notion which so widely prevails that the ideal in American agriculture is the small farm. Numerous real-estate promotion schemes all over the country are based on this idea. It is a distinct fallacy. Very small farms are difficult to make successful anywhere, under American conditions, and it is only the exceptional man who is equal to the task. They must always be devoted to the most intensive types of farming, and the products of most kinds of intensive farming fluctuate enormously in volume and price, so that the business is very insecure. The danger is greatly magnified if these small farms are situated a long distance from market, for prices of their products do not have to fall very far until the transportation charges wipe out all profits. Even in the vicinity of the best markets these small farms succeed only in localities where they have distinct advantages for the particular type of farming which they follow.

RELATION OF THE NUMBER OF DAYS WORK PER YEAR TO LABOR INCOME.

In Table XXIX the 378 owner farms are divided into groups based on the number of man work units (or productive days' work) per farm. One hundred and seventeen of these farms had less than 300 man days' work, with an average of 211. These same farmers had an average of 111 horse days' work. This includes only the productive labor of the farm; that is, labor applied directly to a productive enterprise.

TABLE XXIX.—*Relation of the number of productive days' work per farm to labor income, Chester County owners.*

Man work units per farm.	Number of farms.	Man work units per farm.	Horse work units per farm.	Average size of farm.	Labor income.	Adjusted income.
				Acres.		*Per cent.*
300 and less	117	211	111	49	$336	78
301 to 500	129	395	198	88	703	94
501 to 700	89	588	278	116	1,083	112
701 and over	43	878	378	151	1,668	152
Average	378	439	211	90	789	100

The average labor income on this group of farms is $336, or, figured in percentage, as explained on a previous page, 78 per cent of the average of all the farms. The table shows that as the number of productive work units increases the labor income increases very markedly. Forty-three of these farms had over 700 productive man days' work, with an average of 878, and 378 productive horse days' work. Their average labor income was 52 per cent above the average of the community.

RELATION OF SIZE OF FARM TO USE OF LABOR-SAVING EQUIPMENT.

Table XXX shows quite conclusively one of the striking disadvantages of the small farm as compared with the large farm. Not only is the relative expense of labor-saving machinery greater on the small farm because of the smaller use that can be made of such machinery, but the small farmer frequently can not afford an adequate equipment, especially in the case of the larger machines and implements.

The region of this survey is one in which the disk harrow is particularly useful.

TABLE XXX.—*Relation of size of farm to use of labor-saving equipment on 378 owner farms, Chester County.*

Size of farms......acres..	60 and less.	61 to 100.	101 to 160.	Over 160.	All farms.
Number of farms	115	128	113	22	378
Items of equipment [a]	Per cent of farms reporting.	Per cent of farms reporting.	Per cent of farms reporting.	Per cent of farms reporting.	Per cent of farms reporting.
Disk harrow	22	27	39	64	31
Roller	78	91	94	96	88
Corn planter	43	63	74	82	61
Grain binder	31	70	84	86	63
Grain drill	49	74	90	96	73
Hay loader	....	5	23	27	10
Hay tedder	51	69	81	86	68
Manure spreader	36	65	82	100	63
Silo	3	12	24	45	15
Ensilage cutter and feed grinder	26	44	50	64	42
Engines	23	38	50	64	38
Cream separator	16	9	10	5	11

[a] Practically all farms reported wagons, buggies, plows, harrows, mowers, rakes, cultivators, and harness.

The soil is rather heavy, and the corn crop is usually planted on sod land. Under such conditions the disk harrow is a valuable implement in preparing the seed bed for corn, as well as for other crops. The table shows that only 22 per cent of the farms of 60 acres or less possess this implement, while 64 per cent of the 160-acre farms and larger have disk harrows. The roller, being a less expensive implement, is found on a much larger percentage of farms, but here again the percentage increases with size of farm. In the case of the corn planter, 43 per cent of the farms of 60 acres and under and 82 per cent of the very large farms own their own machines. The farmers of this community overcome this difficulty to some extent by owning corn planters in partnership, which is a very satisfactory plan, for one corn planter can easily plant in season all the corn needed on three or four of these small farms. The same is true of the grain binder. On the larger farms grain binders are quite general, and 86 per cent of the big farms own their binders. Only 31 per cent of the small farms have this machine and must depend upon getting a neighbor's machine. Further consideration of the figures given in this table is left to the reader. They show conclusively that the small farms are inadequately equipped, although, as we have already seen, the value of machinery equipment on them is nearly twice as great per acre as it is on the larger farms.

DISTRIBUTION OF CAPITAL ON FARMS OF DIFFERENT SIZE.

Table XXXI shows the average capital per farm, and the per cent of this capital invested in land, dwelling, other buildings, live stock, machinery, feed, and supplies, and cash to run the farm, for each of the size groups. The last two lines of the table give similar data for 124 tenant farms and 27 special farms. Considering first the farms operated by their owners, the average capital of the entire 378 farms is $10,486; on the 54 farms of 13 to 40 acres it is $4,453, increasing gradually to $23,124 on the 22 farms of over 160 acres. The fourth column of the table shows another reason why it is easier to make a profit on a large farm than a small one.

TABLE XXXI.—*Distribution of farm capital on owner, special and tenant farms, Chester County (per cent).*

Size of farm in acres.	Number of farms.	Average capital.	Land.	House.	Other buildings.	Live stock.	Machinery.	Feed and supplies.	Cash to run farm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
13 to 40	54	$4,453	13.3	35.4	28.9	12.2	6.4	2.5	1.3
41 to 60	61	6,486	20.9	29.4	25.8	13.8	6.4	2.4	1.3
61 to 80	60	8,948	26.8	24.7	24.9	13.4	6.1	2.7	1.4
81 to 100	68	11,045	28.5	22.4	25.6	14.0	5.7	2.4	1.4
101 to 120	52	12,461	28.7	22.9	24.1	14.2	6.2	2.9	1.0
121 to 160	61	14,478	34.8	20.4	23.0	13.2	5.0	2.4	1.2
Over 160	22	23,124	34.3	19.9	22.5	14.9	4.6	1.9	1.9
Total average	378	10,486	28.8	23.5	24.5	13.7	5.6	2.5	1.4
Tenant farms	124	12,030	33.3	22.0	21.5	14.6	5.3	2.3	1.0
Special farms	27	12,893	19.6	30.0	31.9	8.8	5.2	1.9	2.6

The large farms have a markedly greater proportion of their capital devoted to land, which is the foundation of the farm business. On the other hand, the small farms have a very much greater percentage of their capital invested in buildings. The percentage of investment in live stock is approximately the same in all the groups, which merely shows the similarity in type of farming and in farm organization on farms in this region. The percentage of investment in machinery decreases slightly as the farms increase in size. The proportion of the capital represented by feed and supplies is approximately the same in all the groups except the very largest, where it is somewhat smaller. The percentage of the capital represented by cash kept on hand for current expenses does not vary greatly.

We shall later see that the tenants in this area make a considerably larger labor income than owners. The principal reasons for this will be discussed later, but one of them is shown in this table. On the tenant farms the proportion of the capital invested in land is considerably larger than it is on owned farms. This is mainly due to the fact that the tenant farms are on the average larger than the owned farms. The percentage of investment in live stock is somewhat greater on the tenant farms, and the amount of cash to run the farm is somewhat smaller. The 27 special farms, which vary from farms of a few acres to some very large farms with a hothouse business which is merely incidental to the general farm business, have an average capital of $12,893, considerably larger than that of the owner farms and about equal to the total capital—that is, investment of both landlord and tenant—on the tenant farms. But the percentage of capital invested in buildings on the special farms is much larger than it is on the others, while that in live stock is much smaller. The percentage of cash required for current expenses on these special farms is nearly twice as great as on owned farms and two and a half times as great as on the tenant farms.

EFFICIENCY AS MEASURED BY INCOME ON CAPITAL.

In the preceding pages the markedly greater efficiency of the large as compared with the small farm has been clearly demonstrated when considered from the standpoint of the labor income of the farmer; but when we consider the subject purely from the standpoint of the interest on capital invested the story is a different one, as is seen in Table XXXII. In most parts of Europe this matter is considered from the latter standpoint only.

TABLE XXXII.—*Income on capital on 378 owner farms, Chester County.*

Area groups, acres..	13 to 40	41 to 60	61 to 80	81 to 100	101 to 120	121 to 160	Over 160	Total.	Total tenant.	Total special.
Number of farms....	54	61	60	68	52	61	22	378	124	27
Percentage farm income is of capital invested..........	10.4	13.5	13.2	12.7	12.5	12.6	11.8	12.5	13.5	17.9
Percentage of income on investment when value of farmer's labor is deducted..........	4.3	8.0	9.8	9.7	9.8	10.2	9.8	9.4	10.4	14.7

The agriculture of Europe is based mainly on income per acre. In America more attention is given to income per farm family. The reader is left to himself to judge whether it is better for the country as a whole that our agriculture should be efficient from the standpoint of the people on the farm or from the standpoint of the capitalist who owns the land. Fortunately, as yet, in this country the capitalist and the farmer are frequently the same, but even where this is the case it is the income per farm family rather than the percentage of profit on the capital invested which makes for good citizenship in the country and for a high standard of living on the farm.

In making the calculations the results of which are shown in Table XXXII the farm income is first reduced to percentage of capital invested. In the first line of the table the value of the farmer's labor is left out of consideration, the entire net income being treated as the percentage of profit on capital invested. There is seen to be relatively little variation in the figures for different sizes of farms except that in the smallest and the largest groups the figures are somewhat smaller than in the intermediate sizes, and in these intermediate sizes the two smallest show a somewhat larger percentage profit than the three groups of larger farms. The last line of the table was calculated by using the farmer's own estimate of the value of his labor, subtracting this amount from the net farm income, and then expressing the remainder as percentage profit on capital invested. This method corresponds to that usually used in industries where everyone connected with the business receives a salary. The average percentage profit calculated in this manner is 9.4 per cent for the 378 farms operated by their owners. Except for the farms of 40 acres and less, there is comparatively little variation in the profits. It is because profits have so often been figured in this manner that the public has been misled as to the advantages of the large as compared with the small farm. It is interesting to note, as shown in next to the last column of Table XXXII, that the percentage profit on the tenant farms calculated by both methods is larger than it is on the owner farms. We shall later see the reason for this.

The year in which this survey was made happened to be one which was rather favorable to the mushroom business and the average profits made by farmers who grow mushrooms were considerably larger than those of the more usual types of farming in this region, as is seen by the last column of Table XXXII. There are, however, years in which the reverse is very distinctly the case.

DISTRIBUTION OF PRODUCTIVE WORK UNITS.

Table XXXIII gives some interesting data on the relative proportion of the productive labor devoted to crops, live stock, and miscellaneous purposes on the farms operated by their owners. There is seen to be very little variation on farms of different size except that on the larger farms there is a smaller proportion of the miscellaneous productive work. On the average about 41 per cent of the productive man labor is devoted to crops, 57 per cent to live stock, and a little more than 2 per cent is miscellaneous work.

TABLE XXXIII.—*Relation of size of farm to distribution of productive work units, Chester County owners.*

Size of farm in acres.	Per cent of man work units on—			Per cent of horse work units on—		
	Crops.	Stock.	Miscellaneous.	Crops.	Stock.	Miscellaneous.
40 and less	40.1	55.1	4.8	80.8	15.9	3.3
41 to 60	40.5	55.3	4.2	79.6	17.0	3.4
61 to 80	39.7	57.2	3.1	80.9	15.5	3.6
81 to 100	40.5	56.0	3.5	82.6	15.5	1.9
101 to 120	39.5	59.6	.9	81.2	16.9	1.9
121 to 160	41.1	57.8	1.1	82.5	15.4	2.1
161 and over	44.6	54.6	.8	84.3	13.7	2.0
Average	40.8	56.9	2.3	81.9	15.7	2.4

In the case of the productive horse labor, about 82 per cent is devoted to crops, about 16 per cent to live stock, while somewhat more than 2 per cent is miscellaneous in character. The proportion of productive labor devoted to live stock is much larger in this region than it is in many other sections of the country.

TENANT FARMS.

Twenty-four per cent of the farms analyzed in this survey were operated by tenants. This is a much smaller proportion than is found generally in this country. This is accounted for mainly by the relatively small size of the farms. When the owner of one of these small or middle-sized farms rents it out, moves to a near-by village, and undertakes to live on the income from his farm he finds this income insufficient to meet his wants. Hence, it is customary for the farm owner to operate his own farm until advancing age compels his retirement. He is then usually superseded by a member of his own family and retains his residence on the farm.

RELATION OF TENURE TO SIZE OF FARM.

The tenant, even when he owns his own working capital, or half of the principal investment, which in this case is usually dairy cows, has a comparatively small investment. His income is therefore limited to what the farm furnishes toward the family living, what he gets for his labor, and the relatively small income for his invested capital. In order to provide a satisfactory income he must conduct a business of considerable magnitude. Tenants of the better class, therefore, tend to avoid small farms, because of the difficulty of securing a satisfactory living on them. This is clearly shown in Table XXXIV. The percentage of the 13 to 40 acre farms operated by tenants is only 16, while of the farms of 160 acres or more 41 per cent are operated by tenants. The better class of tenants thus wisely choose the largest available farms for which their working capital is adequate.

TABLE XXXIV.—*Relation of the tenure to size of farm on 529 farms, Chester County, Pa.*

Size of farms in acres.	Total number of farms.	Per cent operated by owners.	Per cent operated by tenants.	Per cent of special farms.
13 to 40	76	71	16	13
41 to 60	77	79	18	3
61 to 80	80	75	21	4
81 to 100	91	75	21	4
101 to 120	71	73	21	6
121 to 160	93	66	32	2
Over 160	41	54	41	5
Total	529	71	24	5

This same table shows the percentage of farms of different sizes operating hothouses. The largest percentage is found in the group of smallest farms. In the remaining groups there is not much difference, an occasional farm in each group maintaining a hothouse business.

Table XXXV shows similar data for the entire State of Pennsylvania, for Chester and Lancaster Counties, and for the entire State of Oregon. In general, as the size of the farm increases the percentage of farms operated by tenants increases, within rather wide limits.

TABLE XXXV.—*Relation of tenure to size of farm (census data).*

Size of group.	Percentage tenants of all farmers.			
	Pennsylvania.			Oregon.
	The State.	Chester County.	Lancaster County.	
All sizes	23.3	27.6	37.2	12.7
Under 20 acres	16.8	16.9	30.0	13.4
20 to 49 acres	16.8	21.5	26.6	13.3
50 to 99 acres	22.7	27.2	44.9	12.7
100 to 174 acres	31.4	38.6	54.0	19.2
175 to 499 acres	30.2	44.2	57.3	23.7
500 to 999 acres	19.3	(*a*)	(*b*)	17.2
1,000 acres and over	21.0	....	....	15.1

[a] Chester County, 500 to 999 acres, reports 12 farms and 1 tenant farm.
[b] Lancaster County, 500 to 999 acres, reports 2 farms and 1 tenant farm.

There are sections of the country, however, in which the reverse is true, but they are sections in which the tenants represent a dependent class with little or no working capital, because of which fact they are compelled to occupy practically the status of hired laborers. In general, where the tenant class has little or no working capital a tenant is unable to select a farm with reference to the ease of making a satisfactory income. Under such conditions it is frequently found that the average size of tenant farms is considerably less than that of owned farms, and the percentage of tenancy frequently decreases as the size of the farm increases, especially if the prevailing type of farming is somewhat intensive.

TYPES OF FARMING ON TENANT FARMS IN CHESTER COUNTY.

Table XXXVI shows that in the main the types of farming found on tenant farms in Chester County, Pa., are the same as on the farms operated by their owners, the principal differences being that on the tenant farms a larger percentage of the receipts is obtained from the dairy business.

Table XXXVI.—*Comparison of types of farming on farms operated by tenants and those operated by owners, Chester County.*

	Percentage of receipts.		Percentage of acreage in crops.	
	Owner.	Tenants.	Owners.	Tenants.
Dairy cattle and their products	44.1	53.8		
Beef	1.5	.2		
Horses	.4	.9		
Hogs	2.8	2.3		
Sheep and wool	.5	.1		
Poultry and eggs	8.2	6.7		
Corn	2.3	2.4	22.3	24.6
Potatoes	8.9	6.9	6	5.9
Wheat	8.5	7.9	18.2	18.7
Oats	.2	(a)	6.4	5.6
Hay	14.3	10.6	44	42.9
Fruit	.7	.5	2.5	1.9
Truck crops	.5	.2	.3	.1
Special	[b] .1	[c] .3	(a)	
Miscellaneous	7.0	7.2	.3	.3
	100.0	100.0	100.0	100.0

[a] Less than one-tenth of 1 per cent. [b] Sweet peas, 1 farm; tobacco, 1 farm. [c] Tobacco farm.

On account of the fact that the tenant farms are somewhat more heavily stocked, there is also a slightly larger percentage of acreage in corn. These are the only conspicuous differences in type between the two classes of farms.

LABOR INCOMES ON OWNER AND TENANT FARMS.

The average net income of the landlords who own the 124 tenant farms here under consideration was, for the year 1911, 7.3 per cent of their invested capital. In comparing the labor income of owners and tenants in the same locality, the fairest comparison is made when the interest on capital is estimated in both cases on the basis of the interest received by landlords. Such a comparison is made in Table XXXVII between the 378 farms operated by their owners and the 124 tenant farms found in this survey. When capital is allowed an income of 7.3 per cent, the average labor income of the 378 owners is $548. Under similar conditions the average labor income of the 124 tenant farmers is $739.

TABLE XXXVII.—*A comparison of the labor income of owners and tenants by allowing 7.3 per cent interest on the total farm investment, instead of 5 per cent (7.3 per cent is the average rate of the landlord's interest on investment); survey 1912, Chester County.*

	Number of farms.	Number of acres.	Per farm.		
			Capital.	Farm income.	Labor income.
Owners	378	90	$10,486	$1,313	$548
Tenants	124	106	12,030	1,617	739

Approximately half of this difference is due to the fact that the tenant farms on the average are more than one and one-fourth times as large as the average of the owned farms, but part is also probably due to the fact that the tenant farms on the average have a larger number of dairy cows, usually of somewhat more than average quality. While these tenants make larger labor incomes than the owners, it must be remembered that the owners have the interest on their investment in addition to this labor income, so that the owner's families have larger total incomes than those of the tenants.

This bulletin contains ample evidence that the young farmer who has relatively little capital will find it to his best interests to become a tenant on a farm of considerable magnitude rather than to undertake the same type of farming on a much smaller farm which his capital might enable him to own.

RELATION OF TENANTS' LABOR INCOME TO SIZE OF FARM AND TO TYPE OF TENANCY.

Of the 124 tenants whose business was analyzed in this survey 53 were cash and 71 share tenants (see Table XXXVIII). On the whole, the average size of farms operated by cash tenants was smaller than that operated by share tenants.

TABLE XXXVIII.—*Relation of size of farm to tenant's labor income, capital allowed 5 per cent interest.*

Size of farm, in acres.	Cash tenants.			Share tenants.		
	Number of farmers.	Average capital.	Labor income.	Number of farmers.	Average capital.	Labor income.
60 and less	17	$1,024	$487	9	$925	$428
61 to 100	15	2,219	807	21	1,713	499
101 to 160	14	3,696	1,411	31	2,371	766
161 to 200	7	4,219	1,499	10	2,857	944
Average	53	2,490	954	71	2,061	669

Nevertheless the cash tenants made an average labor income of $954 as compared with $669 for the share tenants, allowing capital 5 per cent interest. As was to be expected, the cash tenants had on the average considerably more capital than the share tenants. The share tenant is usually such because of the small amount of his capital. The tenant who has capital enough to pay cash rent for a farm approximately as large as he wants is inclined to do so because of the greater freedom he thus acquires in his farm operations. He has greater economic independence than the share tenant, and in order to be able to pay cash rent he selects on the average a somewhat smaller farm. From the standpoint of the tenant cash rent is more satisfactory than share rent. From the standpoint of the landlord the reverse is true. In the case of the share renter the landlord is entitled to a larger income on his investment because of the greater responsibility he assumes. For similar reasons the cash tenant is entitled to and receives a larger income than the share tenant.

Table XXXIX shows the relation of the landlord's profits to the size of farm and to the type of tenancy. There is not much difference in the percentage of the landlord's income on farms of different size, except in the case of the very small farms, where the landlord's income is less for both types of tenancy. In the case of the cash tenant the average profits of the landlord are only 3.92 per cent on his investment, while in the case of the share tenant it is 8.81 per cent.

TABLE XXXIX.—*Relation of size of farm to landlord's profits on 124 farms operated by tenants.*

Size of farms, in acres.	Per farm.					
	Cash rent.			Share rent.		
	Number of farms.	Average capital.	Per cent on investment.	Number of farms.	Average capital.	Per cent on investment.
60 and less	17	$3,581	3.09	9	$6,370	6.91
61 to 100	15	6,231	3.53	21	9,181	8.02
101 to 160	14	10,010	4.39	31	12,777	9.48
161 to 200	7	11,557	4.15	10	19,263	8.82
Average	53	7,082	3.92	71	11,803	8.81

The actual amount of the landlord's income increases, therefore, in about the same proportion as the size of the business increases, while the percentage profit remains approximately constant. The tenant's labor income, as was shown in Table XXXVIII, increases markedly with increase in the size of the business, as was found to be the case on farms operated by their owners.

RELATION OF TENURE TO YIELD OF CROPS.

The first line of Table XL gives the average yields of the crops grown in this area on farms operated by their owners, the second line yields on the tenant farms taken as a whole. As is to be expected, yields on the farms operated by their owners are slightly larger on the average than those operated by tenants, but the difference is not great. The last two lines of the table give a comparison of the yields on farms operated by cash tenants and those operated by share tenants. Except in the case of silage, the yields are in all cases larger on the farms of share tenants, the difference probably being due to the greater amount of control the landlord retains of the business in the case of share-rented farms.

TABLE XL.—*Comparison of crop yields per acre on owner and tenant farms, Chester County.*

	Number of farms.	Corn.	Silage.	Potatoes.	Wheat.	Oats.	Hay.
Owners	378	65.3	13.1	78.8	24.8	41.6	1.3
All tenants	124	64.5	11.7	66.4	23.6	37.1	1.25
Cash rent	53	61.8	12.1	54.9	22.0	36.2	1.2
Share rent	71	66.1	11.4	72.7	24.6	37.6	1.3

The average yield of corn on the share-rented farms is actually larger than it is on the owned farms, the yield of hay being approximately the same, while in the case of the other crops the owners have more or less the advantage in the matter of yield.

QUALITY OF BUSINESS.

A very important factor of efficiency in farming is the quality of the business. This is indicated by the yield per acre, the income per animal unit, work units accomplished per individual employed, etc.

YIELD PER ACRE.

Table XLI shows the average yield per acre of the principal crops on the 378 farms operated by their owners, by size of farm. Some of these yields are very high, while others are low. The average yield of corn was 65.3 bushels per acre, which is far above the average for any of the corn-belt States as a whole, and there are few localities in any State that exceed this. The yield of silage is correspondingly high, being 13.1 tons per acre, or an average of 1 ton for each 5 bushels of corn. The season of 1911 was very favorable to the corn crop, and this yield is somewhat above the average for this locality. The yield of wheat is satisfactory when compared with State averages and the average of the country as a whole. The soils of this region appear to be particularly adapted to corn and wheat, though such yields are not obtained by careless methods. There are few localities where farmers make better use of manure than in Chester County or where more manure is produced per acre of crops grown. We shall later see that these farmers get much greater results from a given amount of manure than is the case in some other sections.

The yield of oats here is fair, the average being 41.6 bushels per acre; but here, as in most other localities, the production of nutriment per acre is small compared with other crops grown for feed. The low price of this cereal and the small production per acre make it an unprofitable crop in this section, and it is gradually being discarded by the better class of farmers.

The yield of potatoes is distinctly low. The soil is poorly adapted to this crop. While potatoes should be raised for home consumption, and probably for sale to a limited extent, it is probable that farmers having soils similar to those of this area would not find it advantageous to make this a major crop.

The yield of hay in this region was lower than average in 1911. The average of 1.3 tons per acre is only just equal to that of the country as a whole. The pastures here are among the most productive in the country. The low yield of hay was due mainly to unfavorable weather during the early part of the season, but the practice of leaving hay fields down more than two years, which is not infrequent here, also lowers the average. The first-year hay field usually produces an excellent crop, but if the field is cut for hay for three or four years the yields become very low. By using a somewhat larger proportion of the available manure as a top dressing for hay fields, or possibly by a somewhat more liberal use of commercial fertilizers on these fields, the yield of hay should be materially increased. This would give a better sod to turn under for corn, and this should compensate for the slight loss of manure to the corn crop due to the use of more manure on the hay fields. Hay is one of the most profitable crops in this region, and it should be profitable to go to the necessary expense to produce better yields than are now obtained on the average farm.

RELATION OF YIELD PER ACRE TO SIZE OF FARM.

The plea for small farms has often been made on the basis of the better yields it is possible to obtain by the better tillage that can be given to small areas. It is not questioned that better yields could be thus obtained, but the fact is that American farmers have thus far found it to their advantage to spread their work over more acres rather than to increase unduly the amount of work per acre. Within proper limits they make more profit by this procedure. The figures of Table XLI show that as a rule the farmer who tills a small acreage does not get better yields than those who till larger areas, at least within the limits of the areas found in this study.

TABLE XLI.—*Yield of crops per acre on 378 owner farms, Chester County.*

Acres.	Number of farms.	Corn.	Silage.	Potatoes.	Wheat.	Oats.	Hay.
40 and less	54	62.2	10.8	72.1	25.1	37.0	1.4
41 to 60	61	67.2	12.0	81.5	25.3	38.0	1.5
61 to 80	60	64.6	15.3	78.2	25.6	44.8	1.4
81 to 100	68	64.5	12.7	79.6	24.1	43.0	1.3
101 to 120	52	66.7	12.6	76.1	24.8	42.9	1.3
121 to 160	61	66.0	12.5	75.8	24.3	41.4	1.3
Over 160	22	64.7	13.7	88.1	25.8	38.0	1.3
Average	378	65.3	13.1	78.8	24.8	41.6	1.3

There appears to be very little relation on these farms between size of farm and yield per acre.

RELATION OF YIELD PER ACRE TO LABOR INCOME.

While Table XLI shows very little relation between size of farm and yield per acre, Table XLII shows that within certain very wide limits there is a very distinct relation between yield per acre and labor income. The *crop index*, which is used as a measure of the yields on a given farm, is found as follows: Suppose a given farm produces—

500 bushels of corn on 10 acres;
200 bushels of wheat on 10 acres;
25 tons of hay on 20 acres;

A total of__________ 40 acres.

Suppose, further, that the average yields in the locality are such that, on the average, farmers produce—

500 bushels of corn on 7.7 acres (65 bushels per acre);
200 bushels of wheat on 8.0 acres (25 bushels per acre);
25 tons of hay on 16.7 acres (1.5 tons per acre);

A total of_________ 32.4 acres.

The crop index of the farm in question is now found by dividing 32.4 by 40; that is, by dividing the average acreage in the community by the actual acreage on this farm required to produce the quantities of these products which this farm produces. In this case the crop index is 0.81. Roughly speaking, this means that the yields on this farm are 81 per cent of the average of the community.

In Table XLII the owner farms are divided into groups according to the crop index of each farm.

TABLE XLII.—*Relation of crop index to labor income and adjusted income (per cent); 378 Pennsylvania owners.*

Crop index.	Number of farms.	Average labor income.	Average adjusted income.	Average size of farms.
			Per cent.	*Acres.*
84 and less	75	360	49	89
85 to 99	91	616	74	90
100 to 114	107	870	108	89
115 to 139	92	1,183	153	91
140 and over	13	1,005	130	82
Total	378	789	100	90

There were 75 farms on which the crop index was 84 or less. The average labor income of these 75 farms, when adjusted for size of farm, was just 49 per cent of the average for the whole number of farms.

As the crop index increases the labor income is seen to increase until near the limit of yields found in this survey. But the 13 farms having a crop index of 140 or more had smaller labor incomes on the average than the next lower group. The number of farms in this group is too small to permit very positive conclusions on this point, but these results are consistent with those found in other surveys. Ordinarily it pays well to increase crop yields till they are considerably above the average, but a limit is finally reached beyond which it does not pay to go. Good yields are ordinarily more profitable than extremely high ones, and decidedly more profitable than very small yields.

The last column of Table XLII shows again that there is here very little relation between size of farm and yield per acre. The small farms on the average make just about the same yields per acre as the large ones, and it does not pay their owners to apply the necessary additional labor and materials to increase these yields very materially. In the case of certain crops, however, especially hay, it would probably pay the average farmer in this region to go to the necessary expense to secure a considerable increase in yield. *In general, if crop yields are low, it usually pays to increase them.*

RECEIPTS PER COW AS RELATED TO LABOR INCOME.

Table XLIII shows that the income per cow is a very important factor in the profitableness of farming in this region, as it is wherever such studies have been made. Since dairying is the principal business of the farmers in Chester County, the income per cow is even more important here than in a region where fewer cows are kept.

TABLE XLIII.—*Relation of receipts per cow to labor income, Pennsylvania owner farms.*

Divided according to receipts per cow.	Five and more cows.			
	Number of farms.	Receipts per cow.	Adjusted income.	Labor income.
			Per cent.	
50 and less	48	$42	55	$418
51 to 60	43	68	102	592
61 to 70	27	57	92	783
71 to 80	51	75	99	782
81 to 90	24	86	111	831
91 to 100	39	96	137	1,185
101 to 120	29	110	162	1,422
Over 120	28	138	175	1,602
Total	289	80	111	906

Within the limits found in this survey the labor income increases markedly as the income per cow increases. Forty-eight farmers received $50 or less income per cow. Their labor income was 45 per cent below the general average. Twenty-eight farms had incomes per cow of more than $120, and their labor incomes were 75 per cent above the average.

It is possible to overdo in this direction also, just as it is in the matter of yield per acre, but no farmers were found in this survey who went to too great an expense to get high yield of product per cow. The results of this survey show very clearly that the farmers of Chester County can increase their profits more markedly and more certainly by improving the quality of their cows than in any other way. On farms maintaining large herds this can be done easily enough by using the right kind of bulls. But on the smaller farms this is not always feasible. The right kind of bulls cost so much that the small farmer can not afford them. This difficulty can best be overcome by cooperative ownership of good bulls. Cow-testing associations should be organized, not only as a means of finding which cows are worth keeping and which should be disposed of, but also as a means of providing good breeding stock. With such organizations a good bull can be passed from farm to farm, and thus retained in the neighborhood as long as he is serviceable.

One difficulty in the past has been the fact that so few farmers raised their cows. In order to maintain herds and keep up their quality, it is necessary to replace yearly an average of about one-fourth of the herd. The number of heifer calves saved annually must, therefore, be about 25 per cent of the number of cows kept. In this locality the farmers raise an average of only 8.2 per cent as many heifers a year as they have cows. The remainder of the needed animals are obtained by purchase. The herds can not be materially improved as long as this practice continues; but, as already stated, the prices which it is now necessary to pay for cows in this region are becoming so high that farmers are beginning to raise a larger proportion of their cows. This is perhaps fortunate, for it gives a better chance to improve the quality of the herds.

Because of the large proportion of cows bought, there is considerable mixture of breeds in this region, much more so than would ordinarily be the case where farmers raise their cows. When the practice of raising cows again becomes common, as it seems to bid fair to do, it is important that particular attention be given to the matter of breeds, and more especially to securing bulls from the best producing cows. Every dairy farmer in this region should get firmly fixed in mind the idea that improvement in the producing capacity of cows means increased profits, provided, of course, the ordinary dairy farmer does not have to pay exorbitant prices for the right kind of breeding stock.

The facts given in Table XLIV emphasize strongly the point here under consideration. In this table those farmers who secured $50 or less income per cow are divided into three groups, according to the number of cows in the herds. With cows of this quality, or rather lack of quality, the larger the herd the less the profit.

TABLE XLIV.—*Relation of receipts per cow and number of cows to labor income on commercial dairy owner farms, Chester County.*

Receipts per cow.	Number of cows per 100 crop acres.	Number of farms.	Average number of cows.	Average income per cow.	Labor income.	Adjusted labor income, per cent.
50 and less	1 to 16.9	14	13.7	43.1	405	52
	17 to 22.9	20	19.5	41.2	369	46
	23 to 28.9	11	26.8	45.3	258	32
100 plus	1 to 16.9	15	11.2	137.5	1,090	112
	17 to 22.9	7	19.9	119.7	1,426	182
	23 to 28.9	14	25.4	119.3	1,566	184
	29 plus	23	40.1	125.8	1,723	197

The last part of the table refers to those farmers who secured incomes per cow in excess of $100 per annum. Here, as the herds increase in size, the labor income increases rapidly. This merely goes to show that very poor cows do not pay, while high-grade cows are quite profitable under the conditions prevailing in this area.

COMBINED EFFECT OF YIELD PER ACRE AND INCOME PER COW.

Table XLV shows the combined effect of yield per acre and income per cow. Thirty-four farms have incomes of $60 or less per cow and a crop index of 90 or less. Their average labor income is

47 per cent of the general average. Forty-six farms have cows that produce over $90 worth of products per year and crop yields more than 10 per cent above the average. Their labor incomes average 85 per cent above the general average. Large income per cow is slightly more important in securing a profit than is large yield per acre, but both are important.

TABLE XLV.—*Relations of receipts per cow and crop index to adjusted labor income on 378 owner farms, Chester County.*

Crop index.	Receipts per cow.					
	60 and less.		61 to 90.		91 and more.	
	Number of farms.	Adjusted income.	Number of farms.	Adjusted income.	Number of farms.	Adjusted income.
		Per cent.		*Per cent.*		*Per cent.*
90 and less	34	47	32	70	18	89
91 to 110	28	56	57	103	37	148
111 and more	22	108	36	136	46	185

Farms having cows that produce less than the average should pay special attention to the improvement of their herds, and those which have less than the average yields per acre should give special attention to this point. It is easier to improve poor cows than it is good ones, and it is easier to increase low yields than it is high ones. It is also more profitable.

It is very rare indeed to find a farm excelling in all the factors of efficiency here mentioned that does not make a good profit. Thus, if a farm is devoted to a type of farming adapted to its conditions, is large enough to give full employment at all seasons of the year to the farmer and the labor available to him, has good yields, large income per animal unit, and is adequately and economically equipped, it is almost certain to be profitable. The fewer of these points in which a farm excels the more difficult it is to make it profitable.

EFFICIENCY OF FARM LABOR.

A work unit is the average amount of work done in a day by the average workman. Some men do much less and some do much more than this. Some men also have their work so organized that a given amount of effort accomplishes more work than the average. In Table XLVI the 378 owner farms are classed according to the amount of productive work accomplished per year on them by each individual employed. It is assumed that the farmer himself accomplishes as much work in a year as the average of those employed on his farm. The table shows that there were 22 of these farms on which the average work done per individual employed is less than 100 ordinary days of productive work. The average labor income of these farmers is $181, or $2.18 per unit of productive labor. It is probable that these men really worked at productive labor more than a hundred days during the year, and that many of them did more work on some of their crops than was profitable, for their average yields are above the average of the community. (See next to last column of table.) They also probably spent too much of their time doing things that had no relation to the farm income. That these men were poor managers is shown by the fact that their cows brought them ony $27.60 per head for the year's product.

TABLE XLVI.—*The relation of productive work units per man to profits and other factors in farming on 378 owner farms, Chester County.*

Productive work units per man.	Average per man.	Number farms.	Average size.	Productive work units per horse.	Labor income.	Receipts per cow.	Crop index.	Labor income of operator per day of productive labor.
			Acres.					
Less and 100	83	22	58	38.5	$181	$27.60	103	$2.18
100 to 149	126	62	72	45.2	366	46.80	102	2.90
150 to 199	176	114	90	55.8	625	72.00	98	3.55
200 to 249	222	102	96	59.1	959	78.00	105	4.32
250 to 299	272	49	108	62.7	1,147	78.50	100	4.22
300 to 399	336	23	107	63.2	1,535	77.00	109	4.57
400 and over	448	[a] 6	101	66.7	1,833	83.00	107	4.09
Average	201	378	90	78.3	789	68.20	100	3.93

[a] One farmer out of the six met with serious loss for which he was not responsible, thus causing a minus labor income of $49. The average labor income of the other five was $2,209, with an average wage of $4.93 per work unit.

At the other extreme we have 23 farms on which there was an average of 336 productive work units done per year by each person employed. This does not necessarily mean that each person actually worked 336 days in the year at productive labor, but it does mean that the work accomplished was equivalent to this many ordinary days' work. The owners of these 23 farms made, on the average, $4.57 wages for each productive work unit, as compared with the $2.18 made by the first group. There were six farms (see next to last line of the table) on which the amount of productive labor accomplished averaged 448 ordinary days' labor per year for each man employed. These farms were unusually well managed, and little time was wasted at unproductive work. The owner of one of the six had the misfortune of having contagious abortion get into his herd and had a minus labor income of $49 for the year, but the other five made an average labor income of $2,209, or $4.93 per unit of productive work done.

The income per cow is also much larger on these farms where each workman accomplished a large amount. As would naturally be expected, the average productive work units per horse also increases with increase of work units per man (see fifth column of table).

The fourth column of this table shows that within certain limits the work units per man bears a close relation to the size of the farm. It is on the farms of 100 acres or less that the small number of productive work units per man is found. For farms larger than this there does not appear to be much relation between size of farm and productive work units per man. In other words, with the type of farming and the general farm methods which prevail here, the farm of about 100 acres appears to be the minimum efficient economic unit from the standpoint of the proportion of productive work as compared with miscellaneous work.

FARM ORGANIZATION.

We have already seen that in the Chester County survey area most of the farms are more largely devoted to dairying than to any other enterprise. Yet only 157 of the 378 farms conducted by their owners had sufficient income from dairy products to be classed as real dairy farms. In other words, although this is distinctly a dairy region it is by no means exclusively so. There is considerable diversity in the local farming.

DIVERSITY INDEX.

In order to ascertain to what degree this diversification of enterprises is justified by local experience, it is desirable to have a definite means of measuring the degree of diversification on a farm. The diversity index furnishes such a means. When the enterprises on a farm are all equally important or of equal magnitude the number of these enterprises may be used as the measure of diversity. Thus, if a farm business is based on three equally important enterprises, its degree of diversity is said to be three. But if the enterprises on a farm are of unequal magnitude, the degree of diversity may be determined as follows: First, find the sum of the magnitudes of all the enterprises (in most cases the receipts from an enterprise may be taken as its magnitude),[1] divide the magnitude of each enterprise by the sum above mentioned, square each of the quotients, and divide unity by the sum of these squares. The result is the diversity index.

In Table XLVII the 378 owner farms are divided into groups based on the degree of diversity of their business. Seventy-nine of these farms had a degree of diversity less than 3. Their average labor income, when adjusted to eliminate the effect of size of farm, was 18 per cent below the general average. On 107 farms the diversity index was from 3 to 3.9. Their labor income was 10 per cent below the general average.

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[1] The most accurate measure of the magnitude of an enterprise is the total cost of its conduct, including interest, depreciation, wages, repairs, materials, etc.

TABLE XLVII.—*Relation of divesity index to labor income, 378 Pennsylvania owners.*

Diversity index.	Number of farms.	Average labor income.	Average adjusted income.	Average size of farms.
			Per cent.	
Less than 1 to 2.9	79	$663	82	83
3 to 3.9	107	718	90	90
4 to 4.9	125	888	114	94
5 and over	67	866	112	90
Total	378	789	100	90

On 125 farms the diversity index was 4 to 4.9. These made labor incomes 14 per cent above the average. The remaining 67 farms had a degree of diversity of 5 or more. Their labor incomes were 12 per cent above the average. Thus, under the conditions prevailing in this area, the greater the degree of diversity the higher the labor income until the diversity reaches about the equivalent of 4 to 5 equal enterprises. Beyond this there is a slight decrease in profits. The largest number of farms falls in the class where the profits are largest, so that on the whole the farmers of this locality practice a degree of diversified farming suited to their conditions. There appears to be little or no relation between the diversity of the farm business and size of farm, there being little difference in the average size of the farms in each of the classes of Table XLVII.

Essentially the same thing is shown by the data given in Table XLVIII. Here the same farms are classified by the proportion of income received from the sale of crop products. As in the previous table, there is here very little relation between size of farm and degree of diversity as indicated by percentage of receipts from crops. There is, however, a distinct relation between crop sales and profit as indicated by labor income.

TABLE XLVIII.—*Relation of per cent of income from crops to labor income, 378 Pennsylvania owners.*

Per cent of total income from crops.	Number of farms.	Average size of farms.	Average labor income.	Average adjusted income.
		Acres.		*Per cent.*
0 to 9	19	86	$718	93
10 to 19	35	81	807	117
20 to 29	84	86	804	104
30 to 39	85	95	884	114
40 to 49	70	92	793	94
50 to 59	45	90	732	84
60 and over	40	92	629	83
Total or average	378	90	789	100

Those farms deriving from 10 to 39 per cent of their income from the sale of crops make considerably higher labor incomes than those deriving either more or less of their incomes from this source. There appears to be considerable latitude in this matter, since three of the seven groups are all above the average in labor income. Undoubtedly, a good deal depends on the quality of the live stock kept. A farm having a large herd of cows of very high quality could probably afford to ignore the matter of diversity of business to a much greater extent than one having a herd of medium quality. In other words, quality of business may, within limits, compensate for lack of diversity of business.

THE STANDARD ROTATION.

We have already seen that as early as the latter part of the eighteenth century there began to be practiced in Chester County a crop rotation consisting essentially of corn the first year after sod; flax, oats, and barley the second year; wheat the third year, followed by grass, usually clover or clover and timothy. This rotation is said to have become quite general as early as 1820. Essentially the same rotation is described as being common in 1853. This general form of rotation persists to-day, and is quite commonly practiced, though with some modifications. The more usual form of it as now practiced is: First year, corn; second year, part corn, part potatoes, and part oats or a combination of any two of these; third year, wheat; fourth and fifth years, hay, usually clover and timothy. Some farmers omit potatoes, some the oats (replacing them usually by corn), while there is considerable variation in the length of time the meadow is maintained before plowing it up for corn again. In previous tables the acreage of these crops has been given in percentage of the entire crop area on the farm, including miscellaneous field crops and orchards. In Table XLIX the percentages are reduced to the basis of the crops mentioned.

TABLE XLIX.—*The standard rotation.*

Year.	Crop.	Average acreage on 378 farms.[a]	Suggested rotations.				
			5-year.		6-year.		
		Per cent.		*Per cent.*	*Year.*		*Per cent.*
First	Corn	20.0	Corn	20	First	Corn	16⅔
Second	Corn Potatoes Oats	3.0 6.2 6.6	Corn Potatoes	14 6	Second	Corn	16⅔
Third	Wheat	18.8	Wheat	20	Third	Potatoes Annual hay crop	6 10⅔
Fourth and fifth [b]	Hay	45.4	Hay	40	Fourth	Wheat	16⅔
					Fifth and sixth	Hay	33⅓

[a] Counting only the crops mentioned in this table.
[b] Sometimes sixth also.

The third column of this table gives the actual average acreage of all these crops as found on the 378 owner farms (in percentage). It is seen that they represent very nearly the rotation outlined above. In the next column is given what the data obtained in this survey would indicate to be a somewhat better form of this rotation for the average farm in this region. We have seen (Table X) that the acreage of corn might be increased to advantage. We have also seen that oats are not profitable here. In this rotation the oat crop is replaced by corn. Many farmers, especially those who have silos, have already made this change, and in general their profits are considerably above the average for the region. But this form of rotation, while it is an improvement over the old, does not entirely meet the requirements of the most profitable system as indicated by the results of this survey. The area of wheat is a little too large, while that of hay is somewhat smaller than it should be for best results under average local conditions. It is also difficult to sow so large an area of wheat after corn unless the corn is cut for silage. The soil can not be put in proper condition, the sowing is frequently late, and the land is not left in the best of condition for the succeeding hay crops.

The 6-year rotation outlined in the last portion of Table XLIX appears to meet exactly the condition for greatest profit under average farm conditions in this region. It gives $33\frac{1}{3}$ per cent of corn acreage, which is within the limits indicated to be the most profitable by the data given in Table X. It gives $16\frac{2}{3}$ per cent of wheat acreage, which is almost the same as the present community average, and which, as we have already seen, is within the limits of the most profitable acreage for this crop in this locality. It gives 44 per cent of hay acreage, which is exactly equal to the present average, and which is also within the limits indicated to be most profitable for hay under average conditions in this region. The per cent of potato acreage is the same as the present average.

The annual hay crop occurring in the third year of this rotation presents somewhat of a problem. There are several possibilities to be considered. Oats might occupy this place. They can be cut for hay in the milk stage and make hay of very good quality.

Another possibility is oats and Canadian field peas, though this region is somewhat too far south for success with this combination unless the planting is done very early. Cowpeas, another possibility, are not adapted to heavy soils this far north.

Everything considered, the authors are of opinion that after the farmers have learned the management of the crop, soy beans would be decidedly the best annual crop in this 6-year rotation. It is much more dependable than cowpeas. The hay is rich in nitrogen and would thus considerably reduce the amount of concentrated feed necessary; in fact, with a good crop of soy-bean hay and the additional corn which this rotation would give it would be possible to feed good rations to a large dairy herd with little or no purchase of concentrates. This should considerably reduce the expense of farming here.

It is realized that it is a serious matter to recommend the introduction of a crop that is new to most of the farmers of a region for so important a place in the cropping system as the annual hay crop in this 6-year rotation occupies. This objection holds particularly in the case of soy beans, because of the difficulty of making a success with them in regions where they have not been commonly grown before. The soy bean is a comparatively recent introduction into American agriculture. It is a legume, and the bacteria which it absolutely requires are not generally found in American soils. For this reason nearly every farmer who tries soy beans for the first time makes a failure of them. In view of this fact, the authors recommend that those who try this 6-year rotation use oats or cowpeas for the annual hay crop at first, but it is also recommended that the farmers of this locality begin generally to experiment with a small area of soy beans. This area should be located in some out-of-the-way place, and the first seeding of soy beans should be thoroughly inoculated with the bacteria which this crop requires. The bacteria may be obtained from the United States Department of Agriculture. Another way of inoculating is to get a quantity of soil from a field which has recently grown a good crop of soy beans. The inoculation by this method usually requires from 300 to 500 pounds of soil per acre. This should be done just before seeding. In distributing this inoculated soil, care should be used to avoid the direct rays of the sun, which tend to kill the bacteria. The inoculation should be done on either a cloudy day or late in the afternoon, and the soil should be harrowed at once in order that some of the bacteria may be covered up and thus protected from the light of the sun. Several farmers in Chester County have grown soy beans. A picture of such a field is shown in figure 10.

The first seeding of soy beans is often a failure, but the land will at least get a partial inoculation. The crop should be sown again on the same land the next year, and if necessary, again the third year. Certainly the third year a magnificent crop of soy beans should be obtained. This will supply seed sufficient for sowing the larger acreage in the rotation. Not only that, but the inoculated patch will supply ample soil with which to inoculate the field in which the soy beans are to be sown. The authors believe that when the soy-bean crop has become thoroughly established, and the details of its management are thoroughly understood by the local farmers, its use in the rotation here outlined will be found to add considerably to the profits in farming.

Every farmer who undertakes experiments with soy beans should send to the State experiment station and to the United States Department of Agriculture for the latest literature relating to this crop.

ALFALFA.

Thus far nothing has been said about alfalfa in this region excepting merely to mention the fact that some 75 acres of it were found upon the 378 owner farms. Since this survey was completed the area of this crop has considerably increased in Chester County. Where the cultivation of alfalfa is successful it is a desirable crop for live-stock farms, but the discussion of cropping systems involving alfalfa would lead into a field which is to be covered in another bulletin dealing with cropping systems for the region of this survey and other similar localities. It may be added, however, that on farms having a considerable acreage of alfalfa the 5-year rotation outlined in the middle of Table XLIX might be more satisfactory than the 6-year rotation. The alfalfa when once established should continue to occupy the same field as long as it is producing a satisfactory crop. The remainder of the farm could then be continued in the 5-year rotation.

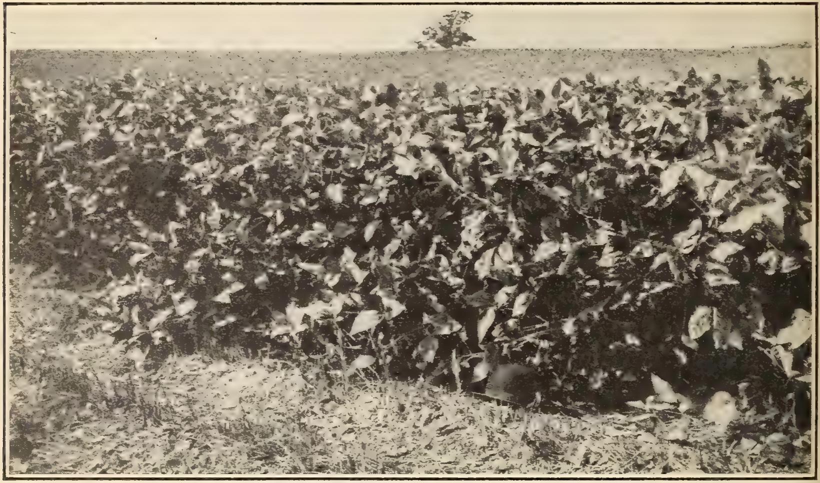

FIG. 10.—Field of soy beans near West Chester, Pa., showing adaptability of this crop to local conditions in area of survey. (Photo by E. K. Hibschman.)

FARM EXPENSES.

The data obtained in this survey are not sufficiently extensive to permit a detailed study of the relation between the expenditures for different purposes and the efficiency of local farming. It is not doubted, however, that such studies would give results of interest in connection with the problems of farm management. As records of farm management surveys accumulate, these more detailed studies will become easily possible. For the present it must suffice to point out certain facts relating to farm expenses which may be useful in making comparisons between the farming of this region and that of other regions where different conditions prevail.

Table L shows the interesting fact that on all sizes of owner farms in the Chester County survey area the expense of conducting the farm business is from 39 to 47 per cent of the total farm receipts. There appears to be no particular relation between size of farm and the percentage of receipts required to meet expenses. There is an undoubted relation of this kind between type of farming and expenses, but since on the 378 owner farms there is little relation between type of farming and size of farm, this relation is not made evident in the tabulated data.

TABLE L.—*Proportion of receipts required for operating expenses.*

Size of farm (acres)	13 to 40.	41 to 60.	61 to 80.	81 to 100.	101 to 120.	121 to 160.
Number of farms	54	61	60	68	52	61
Proportion of receipts required for operating expenses, etc	*Per cent.* 44.7	*Per cent.* 39.1	*Per cent.* 41.3	*Per cent.* 42.6	*Per cent.* 45.4	*Per cent.* 42.2
Size of farm (acres)	Over 160.	All owners.	Tenant farms.	Tenant's share.	Landlord's share.	Specials.
Number of farms	22	378	124	124	124	27
Proportion of receipts required for operating expenses, etc	*Per cent.* 47.1	*Per cent.* 43.2	*Per cent.* 41.0	*Per cent.* 52.4	*Per cent.* 28.0	*Per cent.* 48.7

On the average for all the owners, current expenses amount to 43.2 per cent of the total receipts. On the 124 tenant farms it is a little less than this, being just 41 per cent. It appears that both tenant and landlord are somewhat more economical in the matter of expenditures than is the case with those who operate their own farms, which is to be expected. The owner who operates his own farm has not only a labor income, but interest on his capital as well with which to provide the family living. The tenant has little more than his labor income, while the landlord has only his income on capital. In the case of both landlord and tenant economy is thus more a matter of necessity than it is in the case of the owner operator.

While the total expense of landlord and tenant combined amounts to 41 per cent of the receipts on tenant farms (not counting rent), the data in Table L shows that the tenant expends 52.4 per cent and the landlord 28 per cent of his receipts in the conduct of the farm business. On the 27 special farms on which a hothouse business is conducted, both receipts and the percentage of these receipts required to meet business expenses are larger than on farms of other types found in this survey, the expenses amounting to 48.7 per cent of the receipts.

Table LI shows in detail the nature and relative amount of expenditures for different purposes on owner farms of different sizes and on tenant and special farms. The data for tenant farms are given in the fourth column from the last in such manner as to include both tenants' and landlords' expenses, leaving out the rent paid by the tenant. In the third column from the last the average expenditures of the landlords for the entire number of tenant farms is given. The second column from the last gives the expenses of cash tenants, including rent. The last column gives the expenses of share tenants, not including rent. On owner and tenant farms the largest single item of expense is for hired labor, this item being slightly greater on owner than on tenant farms. The owner operator, having both labor and capital income, can afford to hire a greater proportion of his labor, although, on the average, owner farms are smaller than the tenant farms in this region.

TABLE LI.—*Distribution of farm expenses on owner, special, and tenant farms, Chester County.*

	Acres.												
	40 and less.	41 to 60.	61 to 80.	81 to 100.	101 to 120.	121 to 160.	Over 160.	Total owner farms.	Special farms.	Total for tenant farms.	Landlord's expenses.	Cash-rent tenant.	Share-rent tenant.
Number of farms	54	61	60	68	52	61	22	378	27	124	124	53	71
	P.ct.	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*
Paid labor	13.0	15.4	24.4	28.5	24.6	30.7	36.1	26.8	37.4	23.5	1.2	19.3	35.0
Board, paid labor	4.2	4.6	6.1	7.1	5.8	6.0	3.5	5.6	3.6	5.6	.1	4.3	8.8
Family labor	16.4	16.2	10.1	7.7	12.9	6.9	5.0	9.6	4.1	9.4	1.5	6.4	15.1
Machinery repairs	1.5	2.3	1.4	1.6	2.0	1.3	1.6	1.6	1.3	1.6	.7	1.2	2.0
Building repairs	2.7	1.9	1.2	1.2	1.2	1.2	.1	1.8	.7	1.8	3.6	1.8	.2
Fence repairs	1.4	1.1	.9	.8	1.4	.8	.7	1.0	1.0	1.3	4.3	.2	.2
Drain repairs	......	.1	......	.1	......	......	.2	.1	......	......	.1	......	......
Feed, silage, etc	1.1	.7	1.1	.6	1.1	.6	1.7	.9	.1	.9	.8	1.1	.4
Feed, grain, etc	24.7	19.0	18.1	17.5	19.7	16.0	21.3	18.7	7.6	22.0	26.7	18.4	16.1
Feed grinding	1.6	1.8	1.4	1.5	1.1	1.3	1.1	1.3	.3	1.5	1.8	1.1	1.4
Ice and milk haul	......	......	.6	......	1.0	.3	......	.3	.0	......	......	(a)	(a)
Horseshoeing	2.7	2.9	2.5	2.3	2.0	2.0	1.3	2.1	1.1	2.4	.9	1.8	3.2
Breeding fees, vet	.9	.7	.8	.7	.7	.7	.7	.8	.7	.9	.6	.9	.6
Seeds, plants, etc	3.9	5.8	4.3	5.1	3.4	4.5	3.6	4.3	2.2	3.9	6.8	2.6	2.5
Fertilizer	11.3	13.1	13.5	12.0	11.4	13.0	11.3	12.3	20.8	11.2	20.1	7.8	6.1
Spray material	.1	.1	......	.1	.1	......	......	......	.1	......	.1	(a)	.1
Twine	.2	.4	.4	.4	.3	.4	.3	.4	.1	.4	.2	.3	.4
Thrashing	1.4	1.4	1.6	1.4	1.2	1.5	1.3	1.4	.4	1.4	1.4	.9	1.4
Pressing	1.0	1.7	2.0	1.8	1.8	2.5	2.1	2.0	.8	1.6	1.8	1.0	1.6
Machine hire	.5	.6	.3	.3	.3	.2	......	.2	.1	.3	.1	.3	.2
Fuel, oil, barrels, etc	.5	.6	.6	.7	.7	.7	.6	.7	6.6	.6	.5	.5	.7
Insurance	2.7	2.1	1.9	1.8	1.6	1.9	1.9	1.9	1.2	2.2	6.0	.7	.9
Taxes	8.0	7.3	6.8	6.7	5.8	7.4	5.6	6.7	3.3	7.3	20.2	2.5	2.9
Miscellaneous	.2	.2	......	.1	......	.1	......	.1	.1	.2	.5	(a)	.2
Mushroom spawn	......	......	......	......	......	......	......	......	6.4	......	......	......	......
Cash rent	......	......	......	......	......	......	......	......	......	......	......	26.9	......
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a] Less than one-tenth of 1 per cent.

The next largest item is for concentrated feedstuffs, in this case the expenditure being somewhat greater on tenant farms than on the others. We have already seen that these tenant farms are somewhat more heavily stocked with dairy cows than owner farms are.

The third most important item is for fertilizers, in this case the larger expenditure being made by owner operators. The slight difference in this item on the two classes of farms may be due in part to the larger number of cattle kept on the tenant farms.

The expenditure for hired labor increases materially with increase in size of farm. The smaller the farm the larger the proportion of the work the farm family is able to do. The only other item of expense which shows a noticeable increase on the larger farms is that for baling hay and straw ("pressing"). This is because of the fact that the larger farms sell a somewhat larger proportion of their hay. On the other hand, many of the items are seen to decrease in relative amount as the size of the farm increases. It is quite natural that the item of family labor should thus decrease, for reasons already stated. Expenditures for repairs of buildings and fences, for horseshoeing, insurance, and taxes decrease relatively as the size of farm increases because of the relatively larger proportion of capital invested in the items concerned on the smaller farms. Purchased feed decreases on the larger farms because of their ability to produce a larger proportion of the required feedstuffs.

The largest item in the expenses of the cash tenant is of course rent, which amounts to about 27 per cent of his total expenses. The only other considerable items are for labor, concentrated feeds, and fertilizers. These farms are considerably smaller than the farms of share tenants, and hence the expenditures for hired labor are smaller. The percentage of expenditures for labor on the cash tenant farms is reduced because of the fact that the rent is included in this column, and hence is not directly comparable with the figure in the last column of the table where the rent is not taken into account. If we omit the rent in next to the last column the figure for hired labor would be about 25 per cent, which is about what it should be in comparison with the expenditures of share tenants when the relative size of the two classes of farms is taken into consideration.

It is interesting to note that share tenants have relatively a very large amount of unpaid family labor. These are rather large farms. Amongst owners the only two groups of farms which have as large a percentage of family labor as the share tenants are the two groups of smallest farms.

On the special farms two items of expense overshadow all others. They are for labor and for the horse manure which is the basis of the hothouse business as here conducted.

FEEDING STUFFS.

On the whole, the farmers of Chester County grow a larger quantity of feedstuffs than they feed. They produce a large excess of hay, the majority of farms selling some of this product. A considerable number of farms grow more corn than is needed on the farm and an occasional farmer sells some oats. The average value of farm feed sold per animal unit was $21.08 (see Table LIII). At the same time these farmers bought on an average $10.11 worth of feed per animal unit, mostly in the form of grain and mill stuffs. They thus produce an excess of roughage and a deficit of concentrates. This is the usual situation on farms devoted largely to live stock. In this region nearly every farmer who keeps any considerable number of live stock buys concentrates. The number who sell roughage, principally hay, is less. Some farms sell a large quantity of hay, while others that are more heavily stocked sell little or none. Whether it pays to sell hay depends on the situation on the individual farm. If the dairy cows are of the best quality it would probably pay best to keep enough of them to consume all the roughage grown, buying enough concentrates to make up any deficiency in the quantity produced. Where the cows are of only moderate quality it is undoubtedly good practice to sell some hay. We have already seen that on the average those farmers who sell a small quantity of hay make higher profits than those who sell none or a large quantity. This is probably due to the fact that the average dairy cow in this region is only moderately good. If all were as good as the best, it would, in all probability, pay to increase their number and feed all the hay.

TABLE LII.—*Feed cost per animal unit on 378 farms operated by owners, Chester County.*

Kind of feed.	Amount raised.	Amount sold.	Amount consumed.	Price.	Value of feed consumed.
	Bushels.	*Bushels.*	*Bushels.*		
Corn for grain and other purposes	265,313	25,788	239,525	$0.75	$179,644
	Tons.	*Tons.*	*Tons.*	*Tons.*	
Silage	6,678	....	6,678	4.00	26,712
Hay	12,481	5,642	6,839	18.00	123,102
	Bushels.	*Bushels.*	*Bushels.*		
Oats	54,360	2,725	51,635	.50	25,818
Rye	224	52	172	.80	138
Barley	229	....	229	.75	172
Oats and speltz	160	....	160	.60	96
	Tons.	*Tons.*	*Tons.*		
Straw [a]	5,000	900	4,100	4.00	16,400
Stover [a]	6,000	....	6,000	5.00	30,000

[a] Yield estimated.

Total value of farm feed	$402,082.00
Increase in inventory value	36,061.00
Total value of farm feed consumed	366,021.00
Total value of farm feed consumed per animal unit	49.79
Value of feed purchased	74,304.00
Value of feed purchased per animal unit	10.11
Total feed cost	440,325.00
Total feed cost per animal unit	59.90

Table LII gives the facts concerning feedstuffs raised, fed, sold, and purchased. Almost exactly one-tenth of the total corn produced for grain was sold, the remaining nine-tenths being fed. A much larger proportion of the oats produced was consumed on the home farm. The total value of feedstuffs produced on these 378 farms and not sold, valued at average farm prices, which are somewhat less than market prices, was $402,082. Of this, $36,061 represented an increase in inventory over the previous year, and was hence not fed during the year to which this study relates. This leaves a total of $366,021 worth of feedstuffs produced and fed on these farms during the year, or $49.79 worth per animal unit.

Adding to this the $10.11 worth of feed bought, we have a total value of feed per animal unit of $59.90. The actual commercial value of the feedstuffs used on these farms is thus in the neighborhood of $60 per animal unit. The corresponding income was $84.90, a difference of about $25.

The above figures include all kinds of animals kept on these farms except that in determining income per animal unit the work horses were left out of consideration. It does not follow from these figures that the farmers would have made more profit if they had had no live stock. In the first place, the stock furnishes a very good market for much of the crop products of the farm. Had it not been for the live stock on these and other farms in this region this market with present prices would not have existed. In the second place, the presence of the animals permits a diversification of crops which in itself distributes the labor throughout the summer and part of the winter and thus enables the farmer to do a larger proportion of his work instead of hiring it done. In the third place, the live stock furnishes directly a large amount of employment at times of the year which would otherwise remain unoccupied. We shall also see later that the manure produced by the live stock on Chester County farms has a very decided money value, by reason of the increased yield of crops resulting from its use. This value is about $15 per animal unit. This, together with the excess of income over feed value, gives about $40 per animal unit as reward for labor, shelter, up-keep of equipment, etc., made necessary by the presence of the live stock. Except in the case of poultry and dairy cows, the amount of labor required in caring for farm animals is comparatively small. On the whole, therefore, the live stock in this region appears at least to be paying its way, and the fact that it furnishes the farmer with a large amount of productive labor and at the same time pays a fair price for what feed is consumed fully justifies the types of farming which prevail. Without this live stock these farmers would have been idle a large portion of the year and would have made proportionately smaller incomes.

The classes of feed crops grown and their relative acreage are shown in Table LIII. On the average for all the farms there are grown, for each animal unit kept, corn, 0.62 acre; small grain for feed, 0.18 acre; and hay, 1.23 acres; a total of 2.03 acres of feedable crops per animal unit. In addition to this we have 1.18 acres of pasture per animal unit, a total of 3.21 acres of land devoted to pasture and feedable crops per animal unit.

TABLE LIII.—*Acres of feedable crops and pasture per animal unit on 378 owner farms, Chester County.*

Acreage of farms	40 or less.	41 to 60.	61 to 80.	81 to 100.	101 to 120.	121 to 160.	Over 160.	All farms.
Number of farms	54	61	60	68	52	61	22	378
Number of animal units per farm	7.6	12.5	16.6	20.2	24.4	26.7	41.8	19.4
	Per animal unit.							
Corn for grain Corn for silage Other corn	0.60	0.59	0.60	0.62	0.63	0.62	0.68	0.62
Oats and other grains for feed	.13	.14	.18	.20	.17	.19	.22	.18
All hay	.99	1.05	1.22	1.26	1.15	1.40	1.26	1.23
Total feed crops	1.72	1.78	2.00	2.08	1.95	2.21	2.16	2.03
Pasture [a]	.88	1.08	1.10	1.08	1.23	1.27	1.41	1.18
Grand total	2.60	2.86	3.10	3.16	3.18	3.48	3.57	3.21
Value of farm feeds sold	$13.43	$15.27	$20.55	$20.80	$17.93	$25.41	$30.25	$21.08
Value of feed purchased	12.75	8.85	9.61	9.36	11.10	8.34	13.37	10.11

[a] Does not include work horses.

The last two lines of this table show that a considerable proportion of the feedable crops are sold, the amount realized therefrom being considerably greater than the amount expended for feedstuffs bought.

PRODUCTION AND UTILIZATION OF SILAGE.

Of the 378 owners operating their own farms, 56 had silos (see Table LIV). Silage is fed an average of 203 days during the year, or about 6⅔ months. The average amount fed per day, as estimated by 24 of the farmers feeding this material, was 40 pounds per cow. Estimates of the amount fed per day are presumably based on occasional weighings of the feed given. But in estimating the amount of silage stored on the farm it is customary to base estimates on silo capacity as given by King's rules. The farmers' estimates of the amount of silage stored by them amount to 46 pounds per head per day for the usual feeding period, a difference of 13.1 per cent of the amount stored. If both these estimates are approximately correct, they indicate an average loss of silage stored amounting to 13 per cent.

TABLE LIV.—*Amount of silage raised and fed per head of cattle on owner farms, Chester County.*

Number of cattle.	Number of farms.	Average number of cattle units.[a]	Average number days feeding silage.[b]	Average amount fed per day per head.[b]	Average amount raised for feed per day per head.[b]	Number of tons fed per year per head.	Number of tons raised for feed per year per head.	Loss.
				Pounds.	*Pounds.*			*P. ct.*
1 to 14	5	9	200	38	53	3.80	5.30	28.3
15 to 24	26	20	192	43	45	4.13	4.32	4.4
25 to 34	16	29	224	32	36	3.58	4.03	11.2
35 and over	9	50	212	45	50	4.77	5.30	10.0
Total	56	26	203	40	46	4.06	4.67	13.1

[a] Figured on basis that 2 head of young stock = 1 cow, bull, or steer.
[b] Answers by letter from 24 farmers.

On account of the manner in which this estimate was obtained, the figures here given can only be considered a first approximation at this loss. It should be stated, however, that this estimated loss of 13 per cent is in close agreement with the rather meager chemical investigations of the subject.[1]

It is worthy of note that the largest losses occur on those farms feeding the smallest number of cattle. Unless there are cattle enough to consume the entire surface layer of silage to a depth of several inches daily, there is a good deal of loss from decay of silage left too long in contact with the air.

The average number of tons of silage stored per head of stock to be fed is seen by Table LIV to be $4\frac{2}{3}$. The actual amount fed appears to be about 4 tons per head in $6\frac{2}{3}$ months. The common practice here is to feed silage during the winter, and during periods of the summer when pastures are short.

RATE OF DEPRECIATION OF DAIRY COWS.

The data obtained in this survey make it possible to calculate the rate of depreciation on dairy cows, as well as on farm horses. The rate thus obtained does not, however, represent the annual rate at which an animal deteriorates after it passes its prime, for as the calculation is here made the depreciation of such animals is in part cancelled by the increase in value of animals before they reach their prime. But the rate here obtained does represent approximately the average charge which must be made for depreciation in determining the cost of maintaining the dairy herd. The method of calculation is shown in detail in Table LV. This method may be applied to an individual herd of cows, as well as to the average of a large number of herds.

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[1] See Henry's Feeds and Feeding, edition of 1898, p. 246, where this loss is given as 10.8 to 20.0 per cent.

TABLE LV.—*Showing depreciation of dairy cows on 378 farms operated by owners, Chester County.*

	Number.	Value per head.	Total value.
First inventory	4,196	$56.10	$235,400.00
Cows purchased	589	63.84	37,605.00
Cows raised	345	63.84	22,025.00
Total			295,030.00
Second inventory	4,164	57.01	237,430.00
Cows sold and slaughtered	895	37.36	33,437.00
Total			270,867.00
Difference			24,163.00
Increase at end of year in value		.91	3,789.00
Total loss			27,952.00
Average investment			236,415.00
Rate of depreciation ... per cent			11.82

The results of the calculation are somewhat surprising, and the figures for different regions vary widely. Thus for the Chester County area the average annual loss on dairy cows from depreciation in value is 11.82 per cent of the average of the inventory values for the beginning and the end of the year. Table LVI gives a similar calculation for a survey in an important dairy center in southern Michigan (Lenawee County), in which the corresponding rate is only 4.07 per cent. The reason for this remarkable difference will be made clear shortly.

TABLE LVI.—*Showing depreciation of dairy cows on 300 farms, Lenawee County, Mich.*

	Number.	Value per head.	Total value.
First inventory	2,291	$53.23	$121,942.00
Cows purchased	184	48.48	8,921.00
Cows raised	236	48.48	11,441.00
Total			142,304.00
Second inventory	2,215	51.90	114,967.00
Cows sold and slaughtered	466	42.00	19,572.00
Total			134,539.00
Loss (including decrease in value at end of year)			7,765.00
Decrease in value at end of year		1.33	2,946.00
Total loss			4,819.00
Average investment			118,454.00
Rate of depreciation ... per cent			4.07

In making these calculations it is assumed that it costs as much on the average to raise a dairy cow as the average price at which cows are purchased in the respective localities. This may be in error, but even if the cost is considerably less the results would not vary greatly from those given, because of the relatively small proportion of cows raised, especially in the Pennsylvania area.

The remarkable difference in the rate of depreciation of dairy cows in Chester County, Pa., and in Lenawee County, Mich., is due mainly to the difference in the prices at which cows are bought and sold in the two localities. In the Michigan locality the average price paid for cows by dairy farmers was $48.48. The average price at which these same farmers sold their discarded cows was $42, a difference of only $6.48. In the Pennsylvania locality the average purchase price was $63.84, while the average sale price was $37.36, a difference of $26.48. The Pennsylvania farmer thus loses $20 more per cow bought and sold than does the Michigan farmer. This accounts for the much larger annual charge for depreciation on the Pennsylvania farms.

In the Chester County area the farmers on the average raise 37 per cent of their cows and buy the remainder. In the Michigan locality they raise 57 per cent. The proportion of the average herd discarded yearly is 23 per cent in Pennsylvania and 21.6 per cent in Michigan. The average length of time the average cow remains in these herds is therefore 4.34 years (=100/23) in the Pennsylvania area and 4.52 years in the Michigan area. The yearly percentage of deaths in the herds was 1.69 for Pennsylvania and 1.31 for Michigan.

In the above calculations it is assumed that the few cows butchered were worth on the average as much per head as those sold. As very few were butchered, whatever error there may be in this assumption is of minor importance.

DEPRECIATION OF FARM WORK HORSES.

The rate of depreciation of farm work horses in these same localities is shown by the calculations given in Tables LVII and LVIII. In both cases the annual rate is very close to 5 per cent. This does not represent the rate at which a horse depreciates after he has passed his prime, since, as in the case of dairy cows, this depreciation is partly offset by the increase in value of young horses.

TABLE LVII.—*Showing depreciation of horses on 378 farms operated by owners, Chester County.*

	Number.	Value per head.	Total value.
Value at first inventory	1,369	$135.98	$186,183.00
Value of horses purchased	103	157.36	16,208.00
Value of horses raised	8	157.36	1,259.00
Total			203,650.00
Value at second inventory	1,367	138.95	189,947.00
Value of horses sold	64	128.02	8,193.00
Total			198,140.00
Loss			5,510.00
Increase in price during year		2.97	4,060.00
Total loss			9,570.00
Average investment			188,065.00
Rate of depreciation per cent			5.09

The rate is largely determined by the practice of farmers in disposing of horses while they are still salable at a fairly satisfactory price. If all farm horses were kept until their usefulness was at an end, the depreciation on them would undoubtedly be much greater than the results here found. The death rate would also be much greater. As it is, the percentage of deaths among the farm horses in the Pennsylvania area was 3.58 per cent annually, and in the Michigan area 3.31 per cent. This is not the average annual death rate among horses generally; if it were, it would indicate an average lifetime of nearly 30 years. But it is the average annual death rate of horses during the period they are kept on these farms.

On the average, the farmers of the Michigan locality keep a horse 8.5 years, and sell him then for $18.68 less than they paid for him. The Pennsylvania farmer, on the other hand, keeps his horses an average of 12.1 years, and then sells them for $29.34 less than they cost originally.

TABLE LVIII.—*Table showing depreciation of horses on 300 owner farms, Lewanee County, Mich.*

	Total number.	Value per head.	Total value.
Horses at beginning of year[a]	1,027	$126.50	$129,912.00
Horses purchased	90	161.31	14,518.00
Horses raised	37	161.31	5,968.00
Total			150,398.00
Horses at end of year	1,033	132.91	137,299.00
Horses sold	87	142.63	12,409.00
Total			149,708.00
Loss			690.00
Increase in price during year		6.41	6,621.00
Total loss			7,311.00
Average investment			150,053.00
Rate of depreciation			4.87

[a] Does not include 3 stallions valued at $1,100 apiece.

VALUE OF FARM MANURE PER ANIMAL UNIT.

The data obtained in the usual farm-management survey make it possible to estimate at least roughly the money value of the manure of farm animals on the basis of the actual increase in crops yield on farms having large complements of live stock as compared with those having few animals. The results obtained by the method outlined in Tables LIX and LX will depend on the character of the soil, the character of the crops grown, the value of these crops per unit of product, and on the methods practiced by farmers in the management of manure.

TABLE LIX.—*Value of manure per animal unit determined by comparing two groups of Chester County farms.*

[The first group contains 94 farms (one-fourth of entire number) having the least number of animal units per 100 acres of crops (average, 20.36). The second group includes 94 farms having the highest number of animal units per 100 acres of crops (average, 56.85). Difference, 36.49 animal units.]

Crops.	Acres per 100 acres of crop.[a]	Average yield per acre.		Increase in yield per acre	Increase in production per 100 acres of crops.	Prices.[a]	Value of increased production. per 100 acres of crops.
		Lowest group of 94 farms.	Highest group of 94 farms.				
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*		
Corn	23	59.98	71.83	11.85	272.55	$0.80	$218.04
Potatoes	6.21	79.18	83.09	3.91	24.24	1.04	25.21
Wheat	18.8	23.90	25.56	1.66	31.21	.92	28.71
Oats	6.6	37.86	43.67	5.81	38.35	.55	21.09
		Tons.	*Tons.*	*Tons.*	*Tons.*		
Hay	45.4	1.22	1.55	.33	14.98	22.12	331.36
Total							624.41

Excess of fertilizer used by second group, per 100 acres of all crops	48.00
Increase due to 36.49 animal units	576.41
Increase due to one animal unit	15.80

[a] Areas and prices are the averages for the entire 378 farms operated by their owners. These are used in order to eliminate factors other than the quantity of manure available. The crop areas given here are per 100 acres of the five crops mentioned.

The figures given for the value of manure per animal unit represent merely the increase in crop values due to the use actually made of the manure on the farms in question. The cost of caring for the manure and of spreading it on the fields must be deducted from these figures. The average cost of spreading manure on the fields is about 50 cents per ton, or about $5 or $6 per animal unit. It must be remembered, however, that most of this cost is represented by labor which the farmer may perform himself, and that whatever he gets for his labor is added to his annual income, even if it be less than ordinary wages.

In making these calculations the farms of each locality were divided into four equal classes, based on the number of animal units kept per hundred acres of crops. The calculations relate only to the major field crops, but the figures are handled in such a manner as to credit similar average increases in yield and acre value to minor field crops and to orchard lands.

No account has been taken of whatever manure may have been used on kitchen gardens or on permanent pasture land. There should undoubtedly be some credit for these two classes of land, but as there is no way of arriving at its value no account could be taken of it in these calculations. Studies are now in progress with a view to determining the value of manure used on pasture lands in this and other localities.

Table LX.—*Value of manure per animal unit determined by comparing two groups of Lenawee County (Mich.) farms.*

[The first group includes 75 farms (one-fourth of the entire number) having the least number of animals per 100 acres of crops (average, 19.44). The second group includes 75 farms (one-fourth of entire number) having the largest number of animals per 100 acres of crops (average, 48.53). Difference, 29.09.]

Crops.	Acres per 100 acres of crops.[a]	Average yield per acre.		Increase in yield per acre.	Increase in production per 100 acres of crops.	Prices.[a]	Value of increased production per 100 acres of crops.
		Lowest group of 75 farms.	Highest group of 75 farms.				
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*		
Corn	29.8	51.63	56.00	4.37	130.23	$0.63	$82.04
Potatoes	.7	73.29	85.07	11.78	8.25	.83	6.85
Wheat	15.9	20.84	23.54	2.70	42.93	.98	42.07
Oats	18.4	38.77	44.43	5.66	104.14	.46	47.90
Barley	2.0	24.79	25.76	.97	1.94	1.00	1.94
		Tons.	*Tons.*	*Tons.*	*Tons.*		
Hay	33.2	1.08	1.18	.10	3.32	18.50	61.42
Total							242.22

Excess of fertilizer used by the second group per 100 acres of crops	3.00
Increase due to 29.09 animal units	239.22
Increase due to one animal unit	8.22

[a] Areas and prices are the averages for the entire 300 farms operated by their owners. These are used in order to eliminate factors other than the quantity of manure available. The crop areas given here are per 100 acres of six crops mentioned.

The comparison on which the estimates of value are made is between the fourth of the farms having the fewest animal units per hundred acres of crops and the fourth having the highest number. The farms having most live stock in general had larger acreage of corn than did those with less live stock. As a large part of the increase in crop values per acre was due to the marked increase in the yield of this crop, the actual crop values on the more heavily stocked farms were somewhat greater than the figures given in the tables indicate. But this was due to the greater acreage of the more profitable crop, and not to greater yield per acre. In order, therefore, to ascertain the actual effect due to manure alone it was necessary to use the average acreage of each crop on the entire number of farms. This gives the same relative acreage of each crop on the farms in each group. The prices used are also the average for all the farms, for such differences in prices as occurred on the groups of farms compared were not due to the effect of the manure.

In the Pennsylvania area the increase in crop values due entirely to increase in yields on the more heavily stocked farms is seen to amount to $15.80 per animal unit per year. In the Michigan area the corresponding figure is $8.22. The soils of the Pennsylvania area are in the main of granitic origin, and are more in need of fertilization than those of the Michigan area, which are of glacial origin and contain more lime and soluble mineral matter. Manure being more valuable to the Pennsylvania farmer, he takes better care of it than does his Michigan competitor.

These figures are at best a mere first approximation to an important result. The method here used is entirely new, and may have defects which the authors have overlooked. Its importance, however, appears to justify its publication as a means of stimulating research along this line.

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